

NOTES
of the
THIRTEENTH ANNUAL MEETING

of the

National Collegiate Track Coaches Association



**UNIVERSITY OF SOUTHERN CALIFORNIA
LOS ANGELES**

June 22, 23, 1939

CONTENTS

Page	
1	Long Distance Running..... (E. C. Hayes (Tom Jones (J. P. Nicholson
13	Footwork in the Shot and Discus..... R. F. Templeton
21	Broad Jump..... (Brutus Hamilton (Dean Cromwell
25	Use of Alcohol and Tobacco..... Ralph Metcalf
30	Energy and Fatigue in Distance Running..... Sid Robinson
32	Some Physiological Aspects of Distance Running..... Sid Robinson



1939-40 Officers

(Above)—Karl Schlademan, Washington State College, President.

(Left)—L. N. Snyder, Ohio State University, Vice-President.

(Right) F. P. Johnson, Drake University, Secretary-Treasurer.

Printed at the plant of the Cramer Chemical Co.,

Gardner, Kansas, 1939

Secretary's Note: For the complimentary printing of these notes, the N. C. T. C. A. is greatly indebted to Charles and Frank Cramer of Gardner, Kansas.

FIRST SESSION

JUNE 22, 1939

The Annual Meeting of the National Collegiate Track Coaches Association, held at the University of Southern California, June 22, 1939, convened at 9:45 o'clock. Mr. Fred Tootell, Rhode Island State College, president of the Association, presided:

PRESIDENT TOOTELL: Since most of us have been around the U. S. C. campus and athletic field for the last few days, and all have received an official welcome to sunny California, I guess there is no need of my making a great many preliminary remarks. The purpose of this particular session is to get into some of the important aspects of long distance running and weight throwing, so we might as well get started.

The subject of distance running will be covered by Billy Hayes of Indiana, Tom Jones of Wisconsin and John Nicholson of Notre Dame. All will not speak about the same things, of course, but if you will save your questions until they have all spoken, I believe our discussion of the subject will prove to be more interesting. All right boys, you can now take over.

LONG DISTANCE RUNNING

MR. E. C. HAYES (Indiana): Nick and Tom and I are fortunate enough to have had some good boys. The reason we have had good boys is not because they receive good coaching, but because we have boys who want to run. That is the first requisite. You have got to find boys who really want to run, and like and love to run. When these boys are little fellows, oftentimes they get a foundation that should be credited to the parents and environment and will make some coach famous. Boys who get out and run, and run in their playing, until they are tired and then rest awhile, and then run and rest and run again are building an excellent

background for running in high school and college. And we have the little boy who refuses to be licked, except temporarily. That competitive spirit continues as he grows older and reaches the high school and college age. In my work with boys, the most interesting thing to me has been the development of them. I find real satisfaction in guiding a boy who has an ambition to do something and really enjoys it. There is no satisfaction in coaching boys who want to compete when they are not ready for competition.



E. C. Hayes, Indiana

through competition on his natural vitality and have the power to recuperate quickly from his effort. Well prepared contestants often feel better in the second race than they do in the first, and after they have run two races they are not worn out. The results of my experience convince me that it is an entirely individual problem. I try to learn as much as I can about the boy, his background and home life and opportunity for play. It helps to learn what his hobbies are and why he came to college. We must safely guide him.

Work should be given in easy stages. Alternate running and walking is a sound basis to build up cross-country running. It involves every kind of form used in running and I have found it more successful in developing strength, vitality and endurance than to just keep pouring the work to the boy on the track. He has more interest in his work. Up and down hill work is very important as a background for distance running. You cannot overlook this monotony that comes from sustained effort. If you have a scen-

ic course, that breaks the monotony, it will encourage greater effort. For instance, Tom Jones has a very fine cross-country course around the shores of a lake. It is not monotonous. Nick's course is not so good in that respect as Tom's course. Our course is up and down hill. We change courses. We have three or four that we run so that I do not let a boy feel that there is the grind of that same old course day after day and I find that he has more interest in his work. This preliminary work of building up by means of cross-country goes through the walking and running stages, and you reduce the walking and increase the running.

You have your upgrade work which of course is slow but the principle I use on uphill work is making the boy realize that a hill or an upgrade is a challenge to him. When he comes to an upgrade, instead of beginning to give up on it and slowing down, we have the boy accept the hill as a challenge, just like the hill were another important competitor, and a serious one. He must pay attention to his form in running uphill and when he reaches the top of the hill or the grade or whatever it happens to be in degree he does not slow up. He comes to the level and his form changes, then he tries to go out and run a good pace. Eventually he will come to the down grade. This presents another problem. The hill, the level, the down grade, are all something that involves thinking processes in action. That is a tremendously important thing. The boy who can go along with an alert mind during action is the boy with possibilities as a great runner. He oftentimes will not have the physical ability of the other boys but he is able to make use of everything that he has. He will do a better job of running in the right kind of form uphill and downgrade; and later when he comes to competition he will do the better job in running the pace that is best suited to him in competition. Thus you see it is an individual problem for each boy, as we attempt to build him up. They all improve as they go along.

It is in the process of building where we find weakness, and we cannot always watch those boys if we send them out on a three or four or five mile course. The stop watch is the important thing. I learned when I spent a few days in Finland how important the watch was. Those fellows can take a watch and hold pace and disregard each other. Of course, they do

compete to advantage with each other in their races, but they can go out and do a better job on the watch than we can. I have had a few boys in cross-country who could do a good job on the watch. Our cross-country, while it has been quite successful from the standpoint of winning and losing meets, it is used for that purpose of building boys, and out of cross-country comes my half-milers, milers and two-milers.

I have gone from cross-country into indoor work. I would much prefer outdoor work because any boy that is developed outdoors has better health than the boy who is compelled to work indoors. I have found that is true of all my boys; the one who got the most outdoor activity was the boy who had the greatest vitality and better health. Consequently, I have often worked outside in bad weather. Since we have a fieldhouse the boys would rather stay inside, but even yet I urge them out-of-doors in bad weather occasionally, and think it has a very wholesome effect. I noticed that I had fewer colds with boys out-of-doors than when we worked them in the fieldhouse under almost summer conditions. When we prepare a boy for long distance running in cross-country, (Lash is the most prominent example, because he has been winning over a period of years), we find that he has had an excellent background for pace, not quite enough to push him to his maximum but he could not let up too much, so he has done his best work always when I could get him to run the watch. When he went out to run his five or six miles of his ten thousand meters, and if he had prepared himself for a time schedule, he may set five minutes for the first mile, and of course we gave him time at the half-mile post and usually at the quarter-mile post, that is a little more difficult of course in cross-country but on the track it is a simple problem.

The thing that I found was most difficult was getting the boys to be mentally alert and not get into a pace and become a machine. You can talk about your free-wheeling runners that just seem to go on and on as a machine, but they do become machines and they do not have the intelligence, so the first thing you know they will slow down on pace and will keep slowing down and will not make good time. The problem was to give them definite points

at which they should check on time and then if it is too slow they must get out of that pace, speed it up and be able to come back to the pace that has been assigned to them. If it is a 75 or 76 or 77 or whatever it happens to be in cross-country, that is too slow for track work unless it is ten thousand meters, and then it is slow in a championship meet, for if you are running against someone like the Finns you really have to run. But whatever the time is, if it is a 70 and he starts off to run a 4:45 or a five-minute mile he runs a little faster at first and he goes on up and he then almost establishes a level.

When you talk about running even pace, I never yet have found a boy who could run exactly even pace. He can run a little better when he is fresh. He slows up a little bit in the middle somewhere and then he comes back on the last part of the race, if it is a long race, on the last half-mile. If it is shorter maybe the last 660 or quarter. But this thing of running even pace is not as it sounds because it takes more effort to run even pace after you have been running a mile or two miles, particularly when you get beyond the two-mile. When Lash went down to the N. A. A. U. indoor meet at Madison Square Garden to run 5,000 meters this year we thought he ought to run the first three miles in fourteen minutes. Indoors he was getting some help from the boards. We had him working on that time schedule, but he was not as good this year as he has been. He has not been in college competition. He hasn't been away from our tactics and while he did have somebody to give him time, yet he was varying too much. Every once in a while he got in a rut as he went along, so he ran 14:05 instead of running 14:00. That was not so bad, five seconds on the fourteen. When he had run at Princeton under nine minutes like we hope to see these boys run here Saturday he had a time schedule and he was never off more than one second on any quarter of those eight quarters for the two-mile, showing a very fine ability to be alert on the watch, but he had a little better help there. Conditions were better for giving time. These small tracks make it more difficult because the quarters are not so convenient for timing, but when he ran 14:05 on the first three miles of five thousand meters and when the time was announced I thought him five seconds slow, and he thought the same. That was

the thing that registered in his mind. Then instead of going out on that last part with a little bit more energy he had in his mind, "I can't run 14:25." He was shooting at 14:25 for 5,000 meters. He failed because he paid too little attention to pace, so he ran 14:30. He ran easy pace from there on in, winning the race but with the right mental attitude on his finish he could have made the 14:25.

The reason I am telling you this is because it is very difficult to have a distance runner able to go along and disregard his competition, whatever it happens to be. Of course, he is very lucky if he has another man running along on good pace. Bright who ran with him was never in the lead but was behind within hearing distance, and Bright was doing a grand job on that pace. When they ran the first mile in 4:26.8, Lash had tried to run 4:26, he was eight-tenths of a second off but at all the intermediate points on quarters he was always within a second of time schedule, and Bright, of course, had a little advantage, with Lash setting the pace, and Bright was trying to run right on his pace but Bright had not been drilled enough. He was just as good as Lash but he had not been drilled on that ordeal of keeping his mind on pace. Lash had had quite a bit of work on it and he was in good condition for it. Bright cracked at the mile and half mark. There is no question in my mind but what Bright could have been prepared to run that fast or faster. This is interesting to me now because I have nobody in the two mile, and I am wondering what you coaches here are going to do with your two-milers in the meet next Saturday.

This ability to hold pace is over-looked by most coaches. They do not keep the boy's mind alert as he goes along. That alert mind comes to his rescue when he is beginning to get tired. If he can think about the watch and then when he begins to get tired if he can analyse himself a little bit and if he can talk to himself a little bit, when his legs or arms or whatever it is are beginning to give him trouble, he will be able to overcome that and go along and hold pace. If he follows pace, then his competitor is doing the job for him. If he is to depend entirely on his competitor he can go along more fully relaxed physically and mentally. But the boy who can take responsibility and make pace on the watch with an alert

mind, is the boy who is really going to make records. When these boys have finished cross-country and later go into the more intensive work for track events, you all work at the same basis, using over-distance, at distance and under distance. You work over distance at a much slower pace. You work them at their distance a little on slower pace, and you work them under distance and at a faster pace.

Of course, your distances are divided up. You give them pace as you think they need it. If they are two-milers and work on running 68, 69, 70, 72 quarters for the first mile, they will need considerable work on that pace. They are always trying to develop faster pace on sustained effort. You never get away from that. That is the reason you give them under-distance work in the form of quarters, two-twenties, six-sixties and half miles as the situation demands and as the individual demands, and I would not urge any of you to follow any program that I would ever set up for any single man. You can think of it in terms of your men, but if you start to give one man another man's program of work you are likely to have trouble on your hands. Everything depends on that individual. No two men whom I have had have been able to take exactly the same schedule of work. You all know that I am a firm believer in over-distances for it gives them the preliminary background from the standpoint of health. It enables them to go through competition and to recuperate. They are not just athletes and nothing else, you want them to be feeling good and mentally alert on their academic work, and consequently you have to keep that in view when you make your assignment. Boys cannot be tired from one day to another. They must recuperate. That is why I give them over-distance work as a background, then when the boy is supposed to run himself out in competition I find that he can recuperate with safety. It is an impossibility for him to exhaust himself if he has what I call the right kind of background. Of course, full recuperation for further competition is another matter. That requires some thirty minutes or an hour, but I do think it is very important to remember that background governs the ability to recuperate from day to day. When I switch these distances and have intermediate grounds, I have two-milers running with milers

and I have milers running with half-milers, and then I can throw them all together to make the program of work interesting.

When you divide up the men into relay groups and try to break the monotony of the grind of the so-called distance events I find that these fellows thrive on it. They are all interested in team work. That is, men often do better in relays than at any other type. Oftentimes you can place unexperienced men in relays with good men and the first thing you know they will surprise you and do better than they have ever done before. That is one method we use in stimulating boys who otherwise would be nothing but followers.

It is a great thing to have a good boy who can be a good leader; and if you have two or three it is still better. So if you are able to change the leadership—I give one boy the responsibility one day and then give another boy the responsibility another day on the assignment, of making pace. I keep switching those assignments among the different individuals. I do this to keep boys from simply becoming followers, from being licked by the best man in the group day after day. I have to get my leaders licked every once in a while. Sometimes it is not only wholesome for them but for the other members of the squad. The way I do this is to put them on intermediate grounds. I put a half-miler against a miler at an intermediate distance, and maybe I know from the background of work that the half-miler should be in better shape that day than the miler. Of course, I don't run them for time every day but in that way the miler gets licked and vice versa at times the half-miler gets licked on this pace assignment, but that keeps them mentally alert and from becoming over confident. The most interesting duel along that line that I have ever had was Hornbostel, a half-miler, and Fuqua, a quarter-miler. Hornbostel came down to 660 yards and Fuqua going up to 660 yards. On 600 yards they were on a common level, and I have never had men compete with a fiercer spirit than they did against each other. They think back on those battles on intermediate ground and of the amazing time they could make. Lash and some of these boys have attempted to follow this plan.

Now, we have an interesting problem.

While I just said that I believe in over-distance background I have run out of distance runners, seemingly. I have two freshmen coming along. They have both done middle distance with quarter-milers and one was a hurdler and neither one of them very good in high school. They wanted to go out and make a numeral in cross-country. They made it. I did not see very much of them. They did not look particularly impressive but when they came indoors I thought I would try an experiment on them and give them some distance running with the distance men. Trutt was about the only distance man I had but Deckard and Lash worked out with the group so I used these boys with Lash and Deckard, who are on their own most of the time. They have been in cross-country for condition work and come in occasionally to take pace work on the track, so I took these middle distance men and gave them assignments on Deckard and Lash over distances of half- and three-quarters and the mile, and finally got them up to a longer distance and I found that if I worked them alone and gave them an assignment over three-quarters of a mile they were scared of it and if I mentioned a mile they thought that was impossible, but if I told them to take some laps with Lash and Deckard they thought nothing of it and they were amazed when I ran them the first mile with Lash and Deckard who ran the mile and a half in 6:45. They were trying to run the same pace, but this day Lash had the responsibility of making the time so these boys ran along with him and their instructions were to run as easily as they could on his pace, not to get into a rut, just to follow pace. Lash ran the first mile in 4:28 which was just about what he was trying to run and these boys ran right along with him and they were amazed when they came in. They were running a mile of the mile and a half. That made it seem easy to them since the other fellows were going a half mile farther. They ran that mile in 4:28 and after they had finished they were amazed. Neither of those boys could have run that if they had been assigned to it on their own responsibility. They could not have had good judgment on pace. The older men were running along at even pace and they were running comparatively relaxed. That demonstrates the effect that one man has on the other. If you are following a relaxed runner it is easier for you to stay relaxed, and of course it should

be easy for you to see symptoms of tie-up in a runner that is ahead of you and force you to relax, but oftentimes one boy will get tied up and then another ties up. You have all had that same experience.

Boys who think they are sprinters or quarter-milers come out and run and get mixed in a group doing a lot of running, and first thing you know your short distance man will become a distance man and sometimes the best kind of a distance man. Most of our distance men do not have enough speed. It so happens that men of mine have been the other type. They have had more endurance than speed so they started for distance runs. After Tom and Nick have told you about their system of developing distance runners, I shall be glad to answer questions, but I have always refused to give boys' schedules that were used by outstanding distance men simply because it is an impossibility for them to follow the schedule.

I have had a great many boys write me, and Lash himself has had a great many letters from boys who want to know his schedule of work, and it would be foolish for the average college runner to attempt his schedule of work because he requires so much more of it than does the average boy. He probably requires twice as much work even yet as the average distance or middle distance runner. He could not urge high school boys or college boys to follow his program of work. On the other hand I could not give them Deckard's schedule because he is of the other type. When he finishes a race he has done it on nerve force, and consequently I think it is best to let each man and each coach who is giving advice to a boy be careful and make the advice safe and sane on the amount of work for the boy and have him recognize his limitations and keep in mind that he is building all the time and has a definite objective towards which he is working. And as you go along, you are satisfied that you are making progress, and if the boys are conscious that they are making progress until they have reached the competitive stage, and then expected too much and are discouraged because they cannot win, you must conquer that discouragement and keep their minds definitely on this objective which is, of course, taking into consideration the strength and weakness and the goal that each has in mind. If he is a miler,

it may be 4:45, or 4:30 and then to 4:25 and 4:20.

In progress, he keeps his sight set for something better in the future, and we find many important stages in the boy's development. He always reaches a level where he seemingly can do no better, and where he must review and start over again, and his work may be changed almost entirely. Then he comes back and runs 4:25 easier than he ran 4:30, and then you have another leveling-off process and first thing you know, he will come back and run 4:17 or 4:18. On the other hand you have a lot of boys who reach the 4:30 stage and never get better. That is mental side usually. The coach will always recognize boys' limitations.

When a boy is in the development process, he knows whether or not he can be coming down, and when he gets down in the teens where he realizes that the better than 4:20 miles are no harder to him than were the 4:30 miles. He will come out of the race and recuperate just as quickly from a 4:10 mile as he had recuperated during the earlier stage from the 4:30 mile. This is something that I have spent a good many years following, and I am convinced that I do not know very much about it yet because I have seen something new each year. There is never a year but what some boy has taught me something, and I know you are going through this same stage and you cannot sit down and think that you have the thing solved, because a new boy comes along to you and he is another problem. Of course, the more problems you solve the better able you are to solve the next one, but on the other hand you are apt to become over-confident and make mistakes, and if you do not continually check up on yourself, you are just as apt to make mistakes as the boy in his pace work; so I would like to hear from Tom and Nick here, and I want you to think of that which they are saying in the light of the boys whom they have right here, because they have some very outstanding boys and we will see the most outstanding performances that we have had to date. These boys haven't reached their limit by any means. These milers are going to get faster, and these two-milers are going to be running under nine minutes, and it is foolish to say what the maximum will be.

When you are training for sustained effort in any line, if you talk to people who have been through it, typists or musicians or whatever they are, they go through these so-called slumps that you are talking about. There is always a question then, whether to do as you have done in the past, whether to let up and come back after a rest, or whether to work through and then come back. When you work through, you get worse and worse, and the first thing you know the readjustment takes place, the nervous system adjusts itself to an increased output with a higher degree of skill guided by an alert mind and records are broken. The same result might have been obtained after a layoff period followed by careful review and intensive effort.

You come out on a higher level than ever before. You will go through a season and have a sophomore reach his peak about the second Saturday in May; the third Saturday he will do worse. He has gone stale but you could bring that boy out of that by saving him for just the last two meets. What happens to him? First of all, he hasn't got the background, and second he is too nervous. He dreams of each Saturday and what he is going to do and comes to the point where he has no more nervous energy and no more will power, so that these slumps are nervous and not entirely physical. You have to encourage the boy by telling him that next year he will be stronger. My boys are always better as seniors. I like that but when sophomores go wrong I just tell them I know how much more is in them. "Next year will be better."

MR. TOOTELL: "Thank you very much Billy. Now Tom, if you will carry on."

MR. JONES (Wisconsin): My program is much the same as Billy's. However, I stress technique a bit more in the freshman and sophomore years. Perhaps Billy just skipped this point in his discussion.

I think we could all benefit by paying more attention to beginners who possess the physical and mental qualities that make long distance runners. In finding material for my teams, here is one thing I do that may interest you. In the fall after the freshmen (about 2500) have been given physical examinations, I secure from the Student Clinic the names of all of those who have a heart rate below 70 (about 300) together with their

weight, height sitting and height standing, and their vital capacity. The slow heart rate to my mind is an indication of physical ability. In 1926 the highest pulse rate on the Conference Championship Team was 62—the lowest 52. The most vital factors in being able to run long races is the oxygen capacity of a runner and the speed with which he can eliminate lactic acid.

The mental qualities a man possesses need study and cultivating after you have found his vital capacity (horsepower.) He must be ambitious, a good trainer, not easily discouraged, and above all, willing to work hard. He must also possess nervous stability.

As long as Billy omitted discussing technique, I am going to take a few minutes and point out the things I emphasize. Let's start with the foot, which should be placed on the ground pointing straight ahead—not toeing out. It should be planed as it is brought forward in the stride so that the landing is on the ball, then gently settling down on the heel. I stress ankle suppleness and relaxation a great deal. The heel should be down in the center of the stride. If you watch the footwork of Cunningham, Lash, Fenske, Rice, Zamperini and other good distance runners, you will see this point well illustrated. It is rather hard to describe but occurs in this order—kick-off, planing, landing on the ball of the foot, relaxing the ankle, touching the heel, a straight leg, allowing a slight rest on the bone, then a slight knee bend and a falling forward action. This allows full ankle leverage as you drive off at the start of the next stride.

DEMONSTRATION—The heel isn't down here flat, but is raised a little. It's down as this knee is passing the leg under the body.

I think it's a mistake to emphasize length of stride. A distance runner does most of his work with the lower leg and his stride depends on his strength. For

this reason I think he should be allowed to carry his own stride. However, we should give suppling exercises for the hip muscles so that the runner gets a maximum stride that he can carry with ease after he has loosened up.

The timing of the drive is very important. If a man drives off when his foot is directly under him he is lifting his body, not placing or pushing his foot. To illustrate this point, I usually take one man from my cross-country squad and have him do nothing but heel raising in one spot in the training room (about 70 times per minute) while the others run four miles in about twenty-two minutes. The man who is going nowhere doing heel-raising will tie-up and have to stop four or five times during the period.

We should try and get our runners to move out without lifting the trunk, and this can only be done by allowing the trunk to pass over the center of gravity before the foot drive. It's timing the kick. These are fundamentals in technique that I go over very carefully with freshman and sophomores. I do not try to change the style of juniors and seniors but accept them as they are.

The body, of course, should be carried as relaxed as possible and still maintain balance—just enough tenseness in the muscles to carry the trunk. The muscles of the arms, wrists, and hands should be relaxed, especially the inside ones. However, this depends upon whether you are coaching the English or Finnish style of arm carriage. I am speaking of what is usually thought of as the English or American style.

I also emphasize the relaxation of the throat muscles and believe a man should run with his mouth partly open so that he breathes through his mouth as well as his nose. If the muscles around the mouth are tense, so are those around the breathing apparatus.



Tom Jones, Wisconsin

The wrist of course should be quite relaxed, the hands semi-cupped, the elbows set lightly (not dog paddling) and the eyes fairly well ahead. If you are coaching a following race, the eyes should be set on the back of the men ahead. I think there is an advantage in having the eyes stable in a race.

I also try to teach a man a breathing cycle so that he will inhale while he is taking two strides and then exhale while he is taking two more.

My schedule of work is practically the same as Billy's, but I perhaps coach more of the following type of runner, putting the burden of setting the pace on the other fellow. However, I don't do so continually. My men will go out and set the pace if it doesn't suit them. Some men run better if they set their own pace. I want a man to know pace and go out and set it if it isn't right. The longer I coach, the more I believe in even pace. I used to believe in a fairly fast first quarter, then a slow second and third, and all you have in the fourth. I do the same now to a certain extent; however, I think if you are training for a 4:08 mile, the best way to run it is by :62 quarters.

My daily schedule is about as follows:

Monday—Assuming that it is in the competitive season and the runner ran a race the previous Saturday, I think a miler should plan his work for the week and also his race for the coming Saturday. The work Monday should consist of a warmup period of thirty minutes—running, jogging, striding, and walking. Included in this period would be about ten minutes of body conditioning exercises—mainly stretching. Then an endurance workout over one and a half miles, pulling up with a good burst of speed the last 200 yards; then walk and jog to taper down.

Tuesday—This should be a speed workout. After the usual thirty minute warmup period, take a mile and a quarter in alternate quarters, the first, third and last fast and the second and fourth slow (:90). Then walk and jog a bit to taper down.

Wednesday—Start with the usual warmup. Then take a judgment of pace workout by running three-quarters at racing speed or a little better, timed according to quarters. Rest by walking or

jogging, then take two 150 yard wind-sprints or brushes of speed.

Thursday—Same warmup as advised for Monday. Then go through a mile, taking the first half at racing speed (the speed at which you run your best race), slowing down the next 660 yards and pulling up the last 220.

Friday—Rest or take a very easy workout. Go out and take the usual stretching and suppling exercises. Then jog an easy half or three quarters.

Saturday—Eat a very light lunch or a little breakfast at 10:30 or 11:00 if the race is at 2:00. Report at the training room at 1:00, dress and take the usual daily warmup; then go into the training room and rest until ten minutes before your race starts.

Not every man does the same daily work—it varies with the individual. Track coaching, I think, is individual coaching. However, I try to get my squad to report in a group in the early part of the season because the boys enjoy working that way. Shot putters have a lot of fun working together. Also six or seven distance men work together, one alternating with another to set the pace. It serves the purpose and much better work is done at the same time. Some men will improve faster by working alone as the season moves along because of their nervous makeup. Some men are like race horses. Put them running with another and their competitive spirit is up, the adrenalin starts to flow, and at the end of the season you have drained that type of runner of something that makes winners.

I pay a great deal of attention to the warmup for distant men. My men in warming up will run two or three miles before they come up for their assigned work for the day. We work a great deal on the grass at the end of the season, and during this time we also warmup mostly with suppling exercises—bending and alternating jogging, sprinting, striding, and taking windsprints. The windsprints usually come after the regular work which I call the peak work of the day.

The tactics of distance running varies with the men. If a man can't sprint he will keep the pace even and strong. If he can sprint at the finish he need not be afraid to follow the leader. Going around the curve, I would rather have a man

keep his stride on the outside than drop back and break it.

MR. TOOTELL: Now John P. Nicholson will give us some of his ideas on the same subject. Mr. Nicholson.

MR. NICHOLSON
(Notre Dame): In athletics, boys may be put into two types: the phlegmatic type and the nervous type. The phlegmatic type, we must key up; the nervous type, calm down. You may have a sprinter or jumper who is of the nervous type, but a true distance runner should be made the phlegmatic type. He must have sound sense. He must say to himself, "I can run a race in such and so time. If I run that race and I am beaten, I will have no regrets. If another man is running faster than I would like to go, he is either one of two things; he is better than I am or he is bluffing."

The distance runner makes a fine citizen, one of the plugging type. He is always emotionally stable.

In order to make a distance man run his own race—a race not over his capabilities—he must become watch conscious. He must know to a second how fast he is running each lap. He must build a watch in his head. I know I differ a lot with many coaches who do not like to work the boy against the watch. They feel that he is likely to be run out—exhausted—by this practice. I disagree. I think that the watch is the only thing that can tell whether a man is running half-effort, three-quarters effort or full effort, and if you tell the boy each quarter how fast he is running, he learns to develop this watch that is in his head; otherwise, if run without the watch, he is either likely to run too hard or to loaf entirely too much.

My ideas in regard to training 100 yard men, high hurdlers, high jumpers, broad jumpers, and pole valuters have



John P. Nicholson, Notre Dame

changed very little since I was an athlete; in fact, whenever I have deviated from my original program of very easy jogging and loosening up work on Monday, working fairly hard on Tuesday, working hardest on Wednesday, and practically resting Thursday and Friday, I have always come to grief. In working quarter milers, half milers, milers, and two milers; however, the older I get the tougher I get and the harder I work them. These athletes from the quarter on up must have endurance, and they can get endurance only through running. I believe that a man on Monday should be worked one and a half times his distance at a fairly good pace. He doesn't like to run on Monday. Emotionally and physically, he is at a low ebb, but now if you drive him through one and one-half times the distance at a conditioning, though not exhausting

pace, you will have taught him to do what one must do in running, punish himself, when it is distasteful for him to do so. I do not believe in any speed work on Monday. Muscles tend to injury under speed work, but the over-distance work is not generally dangerous. As an aside here, I might say that over a period of years my system has produced more good half-milers than at any other distance. I think this is true because when I first size up an athlete, I am instinctively always looking for the great one. I feel that a boy to be a great quarter miler, must be a near great sprinter; to be a miler, he must be a good long distance man over cross-country, etc. Most boys do not seem to have these qualities; therefore, instinctively I put them at the half-mile—with the hope that they may be great there—I do not know why.

Coming back to what I said in regard to working the boys, I took a year off some years ago and used my men as guinea-pigs. I found best results were obtained if I gave my quarter-milers, half-milers, one milers and two-milers

over-distance work at a fairly good pace on Monday; sprint work of the repeating type—say four 220's on Tuesday for half-milers at five minutes apart at fast half-mile pace, or four quarter-miles five minutes apart at a fair mile pace; then on Wednesday gave the boys a three-quarter distance work-out at racing speed for the distance. (I will explain further: say, for instance, we have a boy capable of 1:58 for the half-mile. He will run the 660 on Wednesday in 1:27, or if we have a boy capable of running a mile in 4:25, he will run the three-quarter mile on Wednesday in 3:18. This I follow after a short rest of a sprint of a quarter-mile or a good sound 220.) Thursday the work is lightened up even more. I turn to pace work. The boy will run half the distance at racing speed for the distance, rest and then run a quarter of the distance at racing speed for the distance. Friday is a rest day or a light jog.

Now if you will look over this schedule, you will find that you get two pretty hard days' work out of this system: Monday and Wednesday. Tuesday's work might be lighter than I have indicated. It must be hard enough, but not at all exhausting. Now I find this system better than the old system of working hard on Tuesday and Wednesday, because if you work them hard on Tuesday, the fatigue may not allow you to work as hard as you would like on Wednesday, so that you do not get two good day's work besides the race on Saturday or time trial.

One thing that worried me all my coaching life, I have of late years solved to my satisfaction. This is the worry caused by frequent bad races during the season. When a boy ran well one Saturday and did not repeat the next Saturday, it always worried me. I felt that I had worked him too hard during the week and that his bad performance was my fault. I have built up a sense, which most coaches have, of when a boy is going to have a bad day, but I have never been able to dodge those bad days, so if I see one coming up the following Saturday, I simply ignore it; work the boy as hard or possibly harder than normal, knowing that when he comes out of this slump he will be even better and stronger than he would have been had I rested him. The point that I make is that rest does no good. It seems to take exactly ten days for a boy to come out of a slump.

Strange to say, these slumps come in deeper hollows early in the season. The longer the season goes on, the shallower is the dip in the graph of his performance. You would be surprised early in the season to find a half-miler or a miler give a good sound performance, and then you will be depressed by the performance he puts on the next Saturday. You will blame yourself. There is no one to blame. The boy is not in good enough physical condition to hold a high rate of performance that early in the season, so simply forget it. If you wish to have your boy run his best race, you must have meets at least ten days to two weeks apart in order to accomplish this; however, at the end of the season I find that boys can run twice a week with rest in between and run up to a high standard each performance.

As for stride, I believe, as we all do, that the first principle of striding is relaxation. I also believe that many coaches have a tendency to teach their men to over-stride. Each man has a stride length which is right and proper for him. The really short striding fellow must have it lengthened, not too much. The "seven league boot" runners must have them shortened. Too long a stride wears them out, but as to how that stride shall be accomplished is an individual thing. Just because Nurmi ran very erect, with his head back, hitting on his heels, with his arms across him, is no reason why every distance runner should do likewise. His individuality must come into play. I should say that there are two styles of running: The Finnish style, in which they run erect; and the English style, in which the runner does not lift his knees very high, leans forward fairly far and runs with his hands very low. I think some runners can do best with the Finnish style and others best with the English style. On the other hand, I believe that the average boy's stride must be developed for at least his Freshman year.

To illustrate my last remark, when Rice first came to Notre Dame he was a very short striding boy, very sloppy, but he had a wonderful kick at the end of every race. I took him and ran him quarter miles after quarter miles against the watch at moderate speeds, trying to develop his stride. It was hard work, and exhausting work, because his muscles were not used to it. By the middle of

his Sophomore year, he had developed a longer stride, but he had lost his short kick. He was not able to give that blinding speed with which you have seen him run this year, so for a month or so we worked on striding and then shortening up and sprinting, striding and sprinting, until finally his old finishing ability came back and he was both able to stand a good pace and still have this very fine finishing kick left.

Tom Jones just a minute ago stressed that there was no such thing as a change of pace in a distance run. He, like myself, wants rhythm; to have the race divided up into two equal parts and have the man run these parts in the same time. I differ with him on one respect; however, I believe that the sprint demands a change of pace. I believe Tom does, too, only he didn't stress it. The very fact that you go from using one set of muscles to a slightly different set freshens up the athlete and gives him added power and speed. During most of the race the athlete should use the stride at an even pace, but he should use a different pace in finishing up. When it comes to the finish, he should take the stride which best fits him for say a 300 yard dash. Now some runners do best at the finish with the long stride, that is true. Their pace, then, during most of the race should be clipped, so that they will have some slack to let out when they go into their stride. Other runners will run 300 yards best with a short stride. These men should have a longer stride during most of the race, and I think that Rice illustrates this. His finishing stride is a short, choppy one. Naturally, a man who goes into a long stride, should have a long finish, say of anywhere from 300 yards to 660 yards. The man who uses the short stride, however, should start his finish anywhere from 150 to 300 yards from home. This is simply common sense. The short stride goes at a higher rate per hour than the long stride, but will not last as far. I believe that every man should have a finish and that he should not try to win the race by sheer pace. This procedure of trying to run the legs off of his competitors generally ends up in his running the legs off himself.

Now as to rhythm; I certainly believe in rhythm to the nth degree. For instance; a mile runner in a big field might have to chop his stride in order

to get close to the pole and save ground. I would rather see him run wide, keep a steady stride, and thereby hold that fine, economic rhythm.

MR. TOOTELL: Thank you, Nick. We are going to be pressed for time, as usual, but we will have a short question period. I'd like to make the questions brief and I am sure that Nick and Billy and Tom will answer them to the point as near as possible. Then we will hear Dean and Brutus on the broad jump. And now for the questions. Mr. Hayes, what do you do with your boys after you get through your cross country season? I mean boys who run outdoors in the spring. If you give both, like you are preparing for the indoor season, and then always run outdoors those who have run outdoor cross country, and also those who do not run in the winter but are going to have competition in the spring. Do you let them off after cross country season?

MR. HAYES: Formerly when we had no indoor season during the months of January, February and March after cross country was over I gave them a change of activity. I think, runners, if you have a good floor, can play basketball and do a lot of things that are fun, but I do have them run some each week but I do not have them run every day, and if the boy has an objective, that is, if he wants to become a quarter-miler or a half-miler or a miler or anything else he would like to become—I have him keep that in mind and what little running he does then will be something preparing him for his event. You keep in mind development. I always keep that in mind because I think that that is very necessary so far as the mental side of the boy toward his work is concerned, but I do keep play in mind. I don't think you can grind and grind and grind on work and get results. You have to give them a change of activity and of course I have had boys who wanted to play basketball and box. I do not like for them to wrestle too much, but wrestling is very good for some. They get their body work that way, and I keep up their body work and general development. As far as strength is concerned I keep this in mind all the time but I do not permit them to take too much apparatus work except in the case of men working on the field events. I do not think it helps a runner to develop heavy muscle.

We try to keep coordination in mind and give them as much fun as we can. There are a lot of games they can play and then those who really want to, can go outside and do whatever they want to in the way of running, but we do not adhere strictly to a schedule, we just try to keep in mind what the boy is going to become in the spring. Some of them may have a weakness, and most boys do have a weakness somewhere; we try to correct that during the intermediate stage.

MR. SIMPSON (Missouri): You say that you don't rest the boys much. What do you do then?

MR. NICHOLSON: I would say that a lot of erroneous ideas exist then. I was talking about the regular schedule, you see. Weight is considered. You have got to take a couple of weeks in the early season to find out what the best running weight for a boy is. Lots of times a boy will run better at 135 than at 140 pounds. You experiment around a little bit with that. But certainly you have to take the individual boy and work him sometimes three times a week. I really believe that lots of times a boy will run better who has had the background, but it must be there. He may have to have three or four years of real hard cross country running. In the junior or senior year you might work him less. It is an individual case all the way through. What I am trying to get across is that we coaches were gentle and nice to the boys. Not to them! Let them have it.

MR. JONES: Long distance is the best way. That comes in the sprinting stride, doesn't it? It comes in the sprinting stride and I find that cross country work in long distance running is running down way lower, that is with the lower part of the leg. You don't bring the upper part of the leg into play much. You do most of your work with the lower part of the leg and I think that that will correct this lifting.

MR. HAYES: In that connection why don't you run him up hill? That will cure him.

MR. JONES: I don't see any reason why—most of my practice is Monday's work. In shoes, the early work in cross country shoes, but there is a definite work in the other shoes. There is one point that I meant to speak of, and that is the breathing. The best way to preach

breathing is the quiet relaxation, but I don't try to coach it. You can't do that. I try to coach a cycle of breathing—a cycle of four steps. Inhale while you take two and exhale while you take two and develop that into making it a habit of getting into the cycle definitely. Your runners always need more air and they speed up with breathing. In cold weather we breathe through the nose. We practice holding our breath a little bit. I think it develops the tissues of the breathing apparatus. When the air is cold I just use an old steam boiler with benzoin and boric acid set up in a room. They take a whiff of that in the nose. It toughens the tissues of the breathing apparatus. I find also that it toughens the hands of the hammer thrower.

QUESTION: Have you tried this gelatin solution?

MR. JONES: It hasn't hurt them. You will see Saturday whether or not it has done any good. Also those packets Dr. Casmire has made an experiment of. It is very good scientifically. I don't think that it has been done over a long period of time to get real results. His results are very good. It encouraged me to try the thing at least. For the last two weeks we have tried it every day. Have you tried it, Billy?

MR. HAYES: I haven't tried it enough for it to be worth anything.

MR. TEMPLETON (Stanford): You are liable to be in a bad way if you forget your gelatin.

MR. SIMPSON: What kind of a meal does Greg Rice eat before he runs?

MR. NICHOLSON (Notre Dame): Three hours before he runs a little honey and poached egg, toast and tea. Just a regular old meal.

QUESTION: Do you have boys who would rather not eat?

MR. NICHOLSON: Yes, I do.

QUESTION: Do you make them eat anyway?

MR. NICHOLSON: No, I don't. You are speaking about running. I like to have them run at two o'clock. They might want to eat at eleven o'clock. If so, he takes something so that it is possible for his tummy to kid itself.

MR. TOOTELL: This will close our

discussion on distance running. Dink Templeton will now tell us something about the shot put and discus throw. In his 17 or 18 years at Stanford, Dink has had some of the country's outstanding weight men, and we hope to hear some of his secrets. Following this presentation and discussion, we shall adjourn until tomorrow morning at 9:30.

THE SHOT PUT AND DISCUS THROW

MR. TEMPLETON: I think the best way to get to this is to take correct footing and throwing positions and consider the differences in them. So, just get down there (Tootell models) like you are about to put, that is, in standing position. In the shot, the ordinary good shot putter has a slow hip action which enables

his hips to stay behind the shot all the way. It gives him a feeling that everybody tries to get of having the shoulder behind the shot. His hips will not only come through but carry the weight clear forward. With your right shoulder back as far as you can get it, you will have your head back and feel like you are pivoted way around. But you can't be far around. You will lose your body drive forward and you will lose your body lift which is the pushing into it, and you will have very little force left except your momentum across the circle and the strength of your arm alone. Irasmuch as you are not in position to put naturally up in the air from this position, you can't get reach or height out of it. You deliberately change the groove that your shot is in and shove it.

I think that there has been quite a controversy about the position of the left foot, resulting in mistaken beliefs which ruin the shot putter. With the left toe a little behind the line of the expected put, the forward knee bent a little, the back knee a good deal, the body bent a little forward at the waist and hips straight—from that position you

will find that most boys will be able to get through their put and shove a lot better than if they land with the left foot forward, straight ahead of the right. That way it ties up the action of the hips so that the only way you can actually get through your put is by getting your right foot and reversing it, in which case you get practically no drive from the ground.



R. F. Templeton, Stanford

Your fundamental distinction between a good discus thrower and a good shot putter is in the natural feel of his hip action. A sluggish pair of hips means a pretty good shot putter. That isn't hard to teach. It also means that he will have a pretty hard time getting a discus throw. The discus has got to go dragging all the way around. If it ever gets up farther than it should be you can never catch up with your hips again to start the throw. If it is dragging way back then if you land with your hips pivoted around and drag the discus after you do much better. Then the first part of the throw should be a good quick snap of the hips' action to start the discus with a great deal of momentum but without any jerks at all. This is the same hip action as the baseball thrower's in which he starts his throw and picks up his momentum with his hand by snapping his hips at the start. If in attempting to do that he should actually land with his hips completely turned he not only gets his hips clear through so they cannot get enough speed but also they go too far forward and land too far ahead.

It is perfectly possible for some good shot putters to be good discus throwers. It isn't exactly the most natural thing for the fellow who has a type of hip action to be competent at both although the difference is in the hip action in the two different events. If the action is watched and taken care of and he learns to use his I see no reason why a man can't do equally good in both shot

and discus. I have a boy named Anderson now whose hip action is a whole lot better suited to the discus than the shot. It is fast—really fast, and the only reason he can be a shot putter at all is that he has a tremendous amount of power in his arms and shoulders. He comes up wide open, and BOOM! And it is the most terrible putting in the world, but the thing that gives it the impetus is the power. It has been only two years since I had a pretty tough time talking him into trying the shot at all. He doesn't like the discus now and already he has gotten to the place where he won't throw the discus because he doesn't feel that power like when he throws the shot. He is really better suited to be a discus thrower than a shot putter. He does have the power to do that thing which has always been considered pretty much of an impossibility, of landing without any great amount of hip pivot to come in behind the shot and still with lots of lift. He can't get enough on the snap at the start so that with his tremendous amount of power in the first part of the push he can actually get fairly well through the put if he handles it right. I think without any question that the most important thing you can get out of the shot is to be able to take the momentum gained by going across the circle and use it in your actual put, which means that when you do land you cannot stop without losing that momentum, but more than that you lose a lot more than momentum by that stop. The natural tendency that every shot putter has is to land first with the right foot and then the left, but train them to land after the hop and with the left foot just ready to hit with the right, and then you have a feeling that you have straight power, and you feel that the shot is due for a long drive.

The only way that I can see is for the two feet to hit the ground almost simultaneously and if a fellow doesn't time just right he has a difficulty in learning to do that. If he doesn't hit exactly at the same time then the chances are his weight will be too much forward and he won't have the feeling of leaning way back where his momentum would continually help him. If his left toe is just about on the landing with the right foot and it comes down normally instead of holding it up as he lands, he can hardly get away from a continuing momentum going right straight. I think

that is the feeling which was behind the old rocker theory where they thought that if you landed with your foot way up you had that continuing motion, but it takes too long a time to do that, when you land with your left very high. It is practically impossible to get away from a complete stop, in which case you might just as well be putting from a stand. Now I seriously am beginning to wonder if to some of these shot putters the hop is of any use anyway. Anderson puts 52 feet from a stand. It is a funny thing that a fellow starting to work up his put—it seems that if he can get fifty feet without crossing the circle—he is bound to put 55 feet with the added momentum. I once worked on the standing put and got it over 50 feet and couldn't put it any further from the hop, and that always puzzled me until now. I think I know the reason why you can't work up to the maximum from a standing put and expect to be able to use your same form from a hop. From a standing put if you just work into it with a pivot you haven't a tendency of coming way back, which makes it impossible for you to go through with a straight drive so that you can come back as far as you want and still be in good position to drive straight. But when you take the hop that left foot doesn't come down on the ground. You think you are landing the same but you aren't.

There is something about that standing put, once the boy starts getting it out there, he dislikes, and he can't resist working on it and trying to get further and further. I have never had or seen a shot putter who came anywhere near close to that (50 feet) who was able to take a hop and come further than he could from a stand. I have sensed that that is the reason for it. Nearly every shot putter I ever got from high school was taught a form with a particular angle to it which seems to be almost nation wide. In Ralph Rose's putting, and I saw him a good many times, he always faced about 45 degrees. He began with the left foot back, started across and turned in the air to almost 90 degrees, landed and then put. I don't know any short cut to get that out of a fellow's form who is learning it in high school.

I have a sophomore who puts over 50 feet this year and who has the same kind of timing coordination as Johnny Lyman (Stanford '36). He has that swing. That rhythmical swing. I have

worked two years on him to get him so you would swear you couldn't see any part of that shoulder lifting across there and still if you watched that for any length of time you will have your suspicions that it is there and when he starts to put harder the farther he goes.

Boyd Comstock, who is coaching in Italy, has done some interesting things. He has a theory over there that Italians have such a disposition that they must all do a thing exactly the same way, there being no individual differences in any lot. So he works them a while and he makes out a form for any event which must be the standard form, and he has a certain number of instructions and instructors assigned to that form and he teaches them each position of that form. As near as I could get it in the shot you face ahead completely. Take your leg springing forward hop and land in position coming to a stop with your stomach forward and out and the big muscles of the stomach are used in putting that shot. Every time a fellow thought he would put and thought he might cheat a little and not put exactly to form, the minute he did an instructor would pop up and call him on it. I don't see how anybody can take any definite theory of form in an event like the shot and say what to do any more than a fancy dancer flying through the air. You can't take a form and say that that is the way you have to put the shot. I think there are certain fundamentals which have to be applied more or less. One fundamental of course is that you must have that right foot on the ground so that you drive off of it and you must not start your reverse too soon or your drive will be lost. Half or maybe more of shot putters have gotten so now they don't really reverse at all. Anderson has gotten that way for me. It does cure the fault of reversing too soon. I will never be able to believe that it is as effective a method as a reverse properly done because I know that when the reverse is properly done the shot is actuated by the right foot, but I have never seen a shot putter who hasn't one time or another developed the fault of reversing too soon, which means that he has no punch in it at all. He feels like a fighter without a foundation. Also it is like the fancy football halfback who does that pretty rolling block and nobody ever gets taken out.

In going through any particular kind

of form you have got to try to get used to forgetting distance completely for a while. If you can do that then perhaps you can get your form. You can get to the place where you can stand up and start your hop and get across the circle and feel just like a pitcher does taking the wind up. The shot putter has no right to start to put the shot on the hop. It is in the crouch that he feels like he is trying to put. The other should be a preparatory feeling. It is almost impossible to teach a fellow that in a short period of time and if you concentrate too strongly on attempting to give him that pretty form and that nice feeling, that shot becomes too heavy for them and it doesn't go for them any more. You have got to strike a happy medium somewhere and work for form in an attempt to pay no attention to distance whatever. In doing that you are better off than to make them put far. Otherwise they feel like they are putting with about 50 per cent effort and then by gosh they can't go out and put this thing to save their lives. On the other hand if a fellow gets out and puts for three hours a day, effort has got to go somewhere pretty soon. The trouble is not many fellows want to do it, that is, for more than two or three days. If you try to make them do it, they are ruined. If a shot putter thinks he is working too hard, just ask him what he would rather do, get four bits an hour, swinging a pick and shovel or putting the shot for eight hours a day, and see what he tells you for eight hours a day for 50 cents an hour. If a shot putter was made to put as a day laborer he would learn to put the shot just as well and learn control like a greenhorn going up into the woods and swinging an axe. He tears his hands apart inside of a half hour but he can't quit. He keeps on working at least and he becomes a pretty good woodsman, or the same if any other kind of person were to develop like that. The best thing I know is for the fellow to become disgusted with being beaten a little bit too much. Then he is liable to go out there and really give that shot a wrestle. During that time he is bound to learn a great deal about control.

In the shot and discuss there is a blind spot in which the competitor actually loses sight of what he is doing and that is just before he starts the heave and goes into it. His head is liable to be up and back and he doesn't know it. All

he thinks of is that he is going to give it everything he has. It is the same with the discus. I don't think you could expect a man with experience to get entirely away from it. I think Johnny Lyman and Jack Torrance (Louisiana State '35) just about got to the place where they erased that blind spot, but with Anderson, he was blind from the time he first took his beginning spring. From there on he is blind. He doesn't know anything that goes on. It is perfectly senseless to attempt to tell him what he is going to do. The only thing to do to get him any place will be to tell him to try to do anything over and over again. He is bound to get to the place where pretty soon he will have some feeling of where he is and know what he is doing in different parts.

In the discus you have a very similar song. It seems to be universally taught in high schools, and that fault in the discus is a waltz feeling. I guess it is taught because it gives the feeling of rhythm. If they have that rhythm they feel that the discus will go out farther. On the turn they just waltz up and down and up and down. They just cannot throw the discus that way. When you have a fellow come into that waltz in his form, it is a long, long hard pull to get it out of his system. That is the way it feels to him that he should throw the discus. It feels as though it were under control and smooth. If you can get him to go across the way he should with a lot of driving it feels awkward and so forth and he doesn't like it. It is a matter of feeling, and there in the discus you have a blind spot waltz, but very experienced throwers have it and it certainly lasts a lot longer than any other event we have. It seems perfectly ridiculous that the hammer thrower can go out and turn three turns and have complete control in every part of his body. There are very few discus throwers who take the trouble to figure out that after all you only take one single turn to throw. They think that they wind up and from there on they just whirl and whirl and go somewhere. The first thing that the discus thrower has got to learn by shadow work is to get across that circle and have some alertness of where he is.

There used to be two different styles of getting across the circle and both of them are quite wrong. One style was to whirl way around, step, and throw. The

other style was to jump from way back, going high in the air with the first jump and go all the way around and then land. With their whirling style there is no driving from the left leg to give you momentum. There is as much difference between that driving style and the right way as there is to walking up to a foot ball and kicking it, expecting to get momentum with that drive. The other style of jumping all the way around simply uses that momentum going up in the air and when you land about that time you have no forward momentum at all. Just like you would stand there and throw it. About half way between those two styles of throwing is where you get your maximum speed of whirl and also your maximum drive. You whirl half way around until you are falling forward and then you turn and drive. You see, your weight is forward and then you can drive as hard as you want and you won't go up in the air, and then when you have turned your other half way around you land with weight on the rear foot. In attempting to throw the discus put your weight on the rear foot instead of on the forward foot so that in the pivot position at the start instead of raising that left leg up you bend your right knee at the start. The only thing that counts in getting low, is how far you get down on that right knee. Brace the left when you start. Don't let it slip. Pivot against it. If it slides there there is no way from preventing the thrower from landing too far forward. You whirl in the leaning, falling forward position and your weight must be off balance forward and then you drive as hard as you want and you will lean quickly when you want to throw. Most discus throwers that I know have got into this form and they can use it effectively, however in trying to do it, invariably they will fall too far forward and it is just murder. If they can get the feeling of going against this braced left leg, then they throw it in the natural groove and get much greater height than by shoving it into another groove. It has always been my idea that the most important thing for the discus thrower to do was to pivot his whole left side. Let it ride. Don't under any circumstances start to whirl with the left shoulder and arm. If you do you have got to land wide open (chest out). You can't help it. There is no way in the world of getting back again to position.

Another thing is the question of your

height. You go as low down as you can. It is a pretty good thing to get as low as possible to get started right. But not with the head forward. That doesn't go at all. That doesn't mean a thing. If you stay straight out and come down two inches you are really getting down low. From that start you don't have to attempt to stay down all the way and throw because if you do that you are not helping yourself at all. You are landing squatting and without drive. The feeling should be that from the start you should continue to come up gradually all the way so that you will be up when in the throwing position. That would make your momentum in a slight upward plane and a continuous one, not bouncing up and down and breaking the continuity of the momentum so that you can actually be way up almost straight legged. You don't have to be down low to throw. If this thing of figuring your start straight up and you whirl and pivot and then drop down low and then come up higher to throw—that is, I think, every bit as fallacious a way of getting into the discus as the waltz where you go down and break your momentum, or the jump in which you jump up into the air bounding clear around. That is practically the same thing as when you stand up straight and then land in a nice squatted position. What do you want to be squatted for? You want to be where you can get every bit of leg drive.

MR. TOOTELL: Would you tell the boys what you do with your men, take your shot putters and discuss throwers, a fellow who doesn't play football—what do you do with them in the fall and in the spring and how do you handle them?

MR. TEMPLETON: Sometimes I think that I have a good idea about them and I tell them what they should do and they tell me what they are going to do. Generally a shot putter or discus thrower at that hasn't much to do that would hurt

them. I try to work the hell out of them and they try to ditch as much as possible. Some of them are that way.

MR. SCHLADEMAN: How wide a stance should a man take at the front of the circle?

MR. TEMPLETON: I don't believe you can make a definite rule for anyone. You have got to watch a man throw and see how he goes up there in front before you can make any rules. Some of the shot putters have to have a pretty narrow stance when they take off so far across the circle like Bill Watson (Michigan' 39) has been doing this year. That leaves about two feet but I would say that as a general rule the stance should be just about the same. The shot putter has to come from a long way back before he can get any traction to that foot. I don't know whether you could call it a matter of importance or not, but my idea has always been to have it so, for anything to get any drive into it was impossible until his left foot made contact with the ground and he actually got traction from that left foot. That is perfectly normal, but to be with the left foot off of the ground with a heavy shot and attempt to suddenly get drive into it, I don't believe it is possible to do that.

MR. TOOTELL: Thank you, Dink, for new points of view on the shot and discus. This concludes our program this morning. Tomorrow at 9:30 we shall meet in the Physical Education Building to resume our discussions on technique. There will be further consideration of the weight events, a discussion of the broad jump and a presentation of findings with respect to the use of alcohol and tobacco. This will be followed by our annual business meeting and election of association officers for 1939-40.

This session is adjourned.

Adjournment at 12:35 P. M.

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SECOND SESSION

JUNE 23, 1939

The meeting convened at 9:40 a. m.,
Fred Tootell presiding.

PRESIDENT TOOTELL: This morning we shall resume our discussions on the weight events where we left off yesterday. May I present to you Mr. Ward Haylett, Kansas State College.

MR. HAYLETT: Hackney is a peculiar type of boy in two respects. I shouldn't say peculiar, I should say exceptional. He has only one idea and that is to be the best in the world in whatever he is in, and I think that is about the acme of ambition as far as an athlete is concerned, and if he doesn't have some ambition of that kind naturally he is not going to get far. Hackney weighs about 206 pounds at the present time. He has never weighed more than 211 pounds, so you realize that is not large in the sense of a lot of good shot putters. He does have very good muscle tone, good muscle control and coordination, etc. He does have a lot of speed and explosive power in his puts. At times he will not do well except maybe for one or two throws and other times he is just as consistent as he can be. In our meet with Oklahoma U., his second, third and fourth puts were 54 feet two and seven-eighths inches, 54 feet six inches and 54 feet one-fourth inch. I don't know whether that was ever equalled before. The meet where he got the 55 feet 11 inches was an exceptionally good throw. There is a statement downtown that he has just done 56 feet 4 inches in practice. He has never done further than he did out here Tuesday of this week in a legitimate throw. He may have done better but he fouled. The farthest legitimate practice put that he ever got was out here Tuesday. It was 55 feet and a fraction of an inch. He has never failed to do less than a foot or more in competition over what he has been doing in practice so that gives me

a hope that he will some day give an extra good performance.

I may have the wrong idea about coaching but I let a boy do a thing as he wants to do it right from the start, and then try to correct faults. I don't tell him how first but I let him do it as he wants to and then try to analyze his faults and help correct them. The main fault that he (Hackney) has is that usually he goes too far across the circle on the first move. He is fast and strong and likes to fight that thing, and so he naturally generates a lot of power in that first movement, so often he will go so far beyond the center of the circle that he doesn't have time to properly execute his next movement. He can't get his foot out where



Ward Haylett, Kansas State College

it should be and he will drop it considerably to the left because of lack of room and his tail will drop and he will just really try to throw the shot. I always know that when he gets his good puts but he doesn't go as far as usual across the circle. I think that is fundamental in all of our experiences. We have been shown that many times. Another thing that he quite often does, he gets quite a ways back with his shoulders. They are fairly straight. Then you will find him leaning a little farther over on the start of his put than a lot of good men do. He will be more forward. We have found that by doing that he keeps it straighter as he goes across. If he starts up higher he will be back too far later, so he often gets a ways over forward. Of course if you get that to an extreme it would be detrimental. The next thing that I think is demonstrated in all shot putters, as far as I know anyway, any time that the elbow gets out and you get that sort of outdrop, as I call it, movement you are not going to get your distance. That is the thing, that Elmer often drops his hand a little bit lower than most putters

because of the idea of driving the shot straight through. That pushing will bring his elbow down and it is bound to go if you drive it right through, so it seems that he is getting a lower start than most shot putters do.

Another thing about him—a lot of people have said that he was putting off one foot. Slow motion pictures show that to be erroneous. You will all agree that is impossible for a shot putter to get distance of that kind off of one foot. But he is fast and he does have a tremendous amount of explosion at the end, and so he can reverse and follow through I think better than most of the shot putters who are perhaps larger, and a little slower in their action. A man who is slow, and doesn't have the ability may have to stay planted longer and not finish and follow through as he does, but he does get a very good follow through on his puts. He is a horse for work. He likes it. There isn't anything that he would rather do than put the shot. During football he likes that, and he likes to wrestle. He didn't have any indoor competition last year. This year he combined the two (wrestling and shot putting), and did more shot work this year by far than he did last year. I attribute a great deal of the improvement this year to that fact of course. He has volunteered wrestling but doesn't expect to do it. He expects to put all his time on the shot next year. On a shot putter with his qualifications you might get some ideas that might be different than some of these boys who have been putting with a slower movement. He can start, and he has enough control even when he goes so fast, and still be set for the throw. A lot of men can't control themselves like that.

QUESTION: Where is his left foot approximately at the end of the put?

MR. HAYLETT: I think it is too far to the left. It will be around in back of him.

QUESTION: Does his left hip cut?

MR. HAYLETT: His tail is too low. He has enough power and his legs drive him through. If you have noticed several pictures of him and especially one that has been out around—there is a very distinct break in his knees. I know that was one of the best puts that he made. We have a picture which is unofficial on the best mark that he ever got, and I never saw anything more nearly in line at all. He has a lot of power, and when

he gets the right line, or nearly right, the thing really goes.

QUESTION: Two weeks before the conference meet how do you let him put?

MR. HAYLETT: I told you that he likes to work. You have to drive him away. In the latter part of the season he would work hard on Monday and Tuesdays and perhaps a little on Wednesday, with nothing on Thursday and Friday if he was going to have a meet on Saturday, and then if he was going to have a meet on Friday and Saturday we worked him Monday and Tuesday and very little or perhaps not at all on Wednesday and Thursday. That is what we did this week for the meet here. Of course the week before the conference meet he hurt his hand and didn't do anything at all that week. That is another thing. He may not be set for this meet. Soon after he was doing his best putting along the first and second week in May and in some way he fractured his middle knuckle, a line fracture. From the 19th of May until the 5th of June he didn't do anything and then he worked out once on the fifth and competed in a meet in Emporia on the seventh of June, and he worked out twice coming across to California and the first time he looked right after he was hurt, was at Gallup, New Mexico, when he did 54 feet four inches and that was the best put he ever made until last Tuesday. It might have been a good thing for him to get the rest. It might show up that he is not really set for the meet after all, even though he has been doing well.

QUESTION: In the pictures that you have, when the shot leaves his hand, where is his right foot?

MR. HAYLETT: It is beyond the center of the circle in most cases and of course it is pretty well in line. The left foot is off but it is still in contact.

QUESTION: Does he weigh the same this year?

MR. HAYLETT: He is lighter this year. His form is different, in a way. He started last year to put the shot and he went from almost nothing to 49 the first meet he was ever in. The next week he won at the Kansas and the next week at the Drake Relays. Fifty-one feet 10 inches was the best that he got last year. He does four feet more this year so you

can see the difference.

MR. JONES: Back to technique. As I have seen his pictures and seen him put, he has the same thing as Francis of Nebraska, and I wondered how you teach that follow through. The punch at the finish. There are two minor distinctions I have in that part of technique. The follow through—they look as they are going clear out of the circle and then throw their weight on the shot.

MR. HAYLETT: I think it is a matter of temperament. Both those boys were fighters. They like to battle. I emphasized too, just in practice work, to get out as far as he can and things of that kind, and another thing that I think is important there although it might not have any bearing: Sam Francis and Elmer Hackney are from the same school, that is, high school. Elmer had only one ideal as far as athletics were concerned and that was Sam Francis. He wanted to beat every record that Francis ever made. So there is a little psychology there that you won't get among other athletes. He had the pattern of Francis in his mind. Francis did a lot more putting than Hackney is high school. He did 53 feet and 54 feet (12-pound) in high school while Hackney never even went to the meet, so it may have been imbedded in his mind of seeing Francis do it in high school. I'm not sure.

MR. JONES: It seems that it takes a lot of coordination and speed to execute that.

MR. HAYLETT: That is right. It does.

MR. JONES: Do you think you could teach that to a big shot putter?

MR. HAYLETT: I have two other shot putters, one weighing 17 pounds more than Hackney. He has done 48 feet five and one-half inches. He is big and slow and he can't do what Hackney does; so you can't tell anything about it. On the other hand I had a man who does 45 feet and weighs 215 pounds, and if anything he is faster than Hackney, but he has no coordination. He never knows what any given part of his body is going to do. I don't believe you can teach it except to help develop and keep them at it, and if you have a boy with a temperament like he has I think perhaps you can get your speed and coordination. I don't believe you can take a slow thinking big man and ever teach him that sort of fin-

ish. I don't believe it is possible to do. It is like taking a slow man and trying to make a 25-foot broad jumper out of him. The chances are that you are not going to do it. If you have a boy that has it, however, you can help it along. After all, that is true in all our coaching. If a boy has an ability you can polish him up and help him out along that line but after all we can't do miracles.

QUESTION: Of course natural strength has a lot to do with it. Hackney's pretty powerful, isn't he?

MR. HAYLETT: I think strength does it. Although Hackney's muscle tone and power is as great or greater than that of most men of his ability.

QUESTION: He is awfully strong and awfully well built. What about those legs he got plunging through lines and things?

MR. HAYLETT: He has a lot of power all over. There is no question about it. If he was on some more highly publicized teams in football he would be just as nearly all-American in football as in track. It is because he has that determination and drive.

QUESTION: Do you use a heavier shot at the beginning of the season?

MR. HAYLETT: No. It is a peculiar thing, but in spite of the fact that he is so strong he doesn't have very strong hands. I don't know whether a heavier shot is more valuable or not, if you want to develop a sense of the 16-pound shot being lighter. I don't think that matters to a powerful man.

QUESTION: Is there any advantage in having the smaller shot?

MR. HAYLETT: I think Hackney puts a bronze shot better than he does a lead shot. I don't know whether it makes any difference or not. He can pick up a bronze shot and put it just as far easily. I would almost bet money that he could put a bronze shot just as far or farther than a lead one.

QUESTION: He is not temperamental, is he?

MR. HAYLETT: He is the easiest boy to handle that I have ever seen. He has no sense of superiority or anything. He wants to win. That is the whole story. Just like I said, he has only one ambition

and that is to be the best in the world in anything he takes up. He would like to win the Olympics in both wrestling and track. That is the way that he feels.

M R . T O O T E L L : I don't believe we should spend much more time on the shot because we have a full program this morning. Brutus Hamilton and Dean Cromwell, a couple of California experts, have agreed to lead a discussion on the broad jump. Brutus, whose experience in track and field started in the Middlewest, will speak first.

THE BROAD JUMP

M R . H A M I L T O N (California): I am a plain sissy when it comes to the broad jump. I think that it is a treacherous event. One of the most treacherous. I try to handle my men with silk gloves and protect them against injury because some men pull muscles very easily in this event. It won't take me long to tell you what little I know about the broad jump or how I coach it. I like to reduce these events to simplicities and teach a few fundamentals to get the boys in condition and the mental attitude right: the desire to excel and win and letting it go at that. If a boy comes along in the frosh class, we have a talk about the broad jump if he is a broad jumper and has, say, a mark about 21 feet. The first thing I do is to get his last three high school meet jumps. They will tell you that they can jump 22 feet 6 inches and then you find he did it once with the wind, and that he was beaten several times, so we take the last three meets that he has competed in and that is the mean from which we work. Then I tell the boy that there are three unpardonable sins that I don't want him to commit in the broad jump. One of those is fouling out. Anyone is apt to foul one jump out of three or occasionally two out of three, but it is an unpardonable sin for a man to foul all his preliminary jumps and not make the final. Another unpardon-

able sin is insufficient warm-up. We can spend considerable time telling the men how to warm up for the event and how to get ready for the competition. Another unpardonable sin is jumping at any time without sufficient heel pads or without wraps if they need wraps for their ankles.

Then I also tell the boys that unless certain things occur, that I as coach should be indicted—for example, I tell him that if he isn't jumping further under this system under which we work than he was at the beginning then I should be indicted as his coach. Or if I let him jump too much or hurt himself unnecessarily then I should be indicted. So we talk this event over and we keep a graph and we start to learn how to jump and get in condition and form. There

are only a few fundamentals that I stress. I don't like to get too involved. I don't like to have the men get form conscious. I like to teach them a few of these fundamentals and practice them until they become self-adjusted and they can try their wings in competition and see how far they can go.

One of the first fundamentals is getting off the board. The broad jump is really a simple event. Briefly it is merely this: Transferring your forward momentum to upward and forward momentum with the least amount of resistance and the greatest amount of efficiency off the board. You do that by getting off the board correctly which is of course with the weight pretty well forward on the ball of the foot and with the chest up. That is, I think, the biggest fault of all broad jumpers, particularly those in high school, that of getting off the board without the chest up. I have men who duck off the board. The runner will duck down and throw his feet out in front and let it go at that. However if he is jumping correctly, he goes up about three or four feet, head and shoulders up, gets the hip throw and lands with the feet as far extended as possible. That



Brutus Hamilton, California

is the main thing in technique that I stress, getting the chest up off the board, throwing the hips into the jump, landing with the feet fully extended. If a man leaves the board correctly with the weight forward and throws his chest out I don't care whether he uses a kick and a half or a rocking chair form or whatever form he uses, but I do insist on getting that chest up off the board. We have the jumpers land as though they were trying to stick their feet into a picture camera at the end of the pit. We find that that sometimes works well.

The run, we spend a great amount of time on. First of all we get the take-off as outlined in Tom Jones' book and all practical field books. There is no need to go into the method of getting the take-off. We never get it in the broad jump pit. We get it on the track where the surface is similar to the broad jump lane. We run approximately 115 to 120 feet, some run a few steps less and some run a few more. We have three take-off marks. The one at 115. We have another at about 90, and another at about 55. I believe the first two require six strides and the last one eight. We start at about 115 and let him run through gathering his momentum, check his right foot at both the other marks and check where he hits this imaginary toe board that we use. We have in practice a lot of practicing running through the take-off but we never do it on the broad jump pit. In the first place a man steps in that pit and it is pretty treacherous. They often pull muscles doing that so we never run through that pit. Consequently we will come over on the track and make a toe board out of lime and we will mark off their take-off marks and we will put a mark out at 23 feet from the board. And here is another fundamental that I stress. I don't know whether it is valuable or not. These boys run through this take-off on the track time and time again until they just get it down almost automatically, then as they get to the board they look out to the approximate distance that they hope to jump some day. After we get within three or four strides of the board we never look at it again. Take the eyes off the board and look well out into the pit. I think that is important. My boys never look at the board after they get within 12 or 15 feet of it but look out into the pit where they hope to jump, and that helps to get

them off the board correctly and helps to get their chests up.

Now in practicing the technique of the actual jump in the air we will jump from four or five strides back only. We do a lot of that kind of work getting off the board. Now you will find that your freshmen and sophomores will be able to get off that board with pretty good technique from four or five strides back but they won't be able to transfer that technique into their running broad jump in competition in their freshman and sophomore years. You can vary them a little if you want to let them practice jumps, but I prefer the longer waiting method of letting them come gradually, making pace slowly and rather than taking the chance on hurting them, let them get that technique better their junior and senior years. We have to do a lot of jumping from four or five strides back. We never jump the full distance in practice for two reasons. One of them is that it might get a man hurt. The other reason is that I have never seen a broad jumper yet that could jump far enough in practice to encourage him. Bob Clark, who was a great jumper, never jumped over 22 feet 6 inches in practice in his life, and he never failed to jump less than 25 feet in competition. We call that shadow jumping just as your discus and shot hops are shadow hops. When they run through, they look out to the approximate distance that they hope they will some day jump; they do a lot of that and a lot of exercises and so on, but they do very little actual jumping. Most of us have had the experience of having good jumpers as sophomores and poor jumpers as seniors. The same is true in the javelin and high jump. Also it is true in the sprints sometimes. A man should improve gradually. I have a jumper this year who was a good jumper as a junior but this year he is handicapped with a sprained ankle and hasn't jumped well all year long. That is all that I know about the broad jump.

MR. TOOTELL: Thanks, Brutus. Dean, have you any remarks to add on the broad jump?

MR. DEAN CROMWELL (Southern California): To convince the youngsters that they are not in uniform stride, and lacking a uniform stride they can't jump, I usually have them run the opposite way of the runway, stepping first

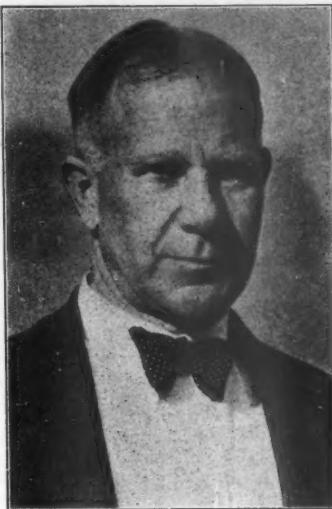
on the board as they run in the wrong direction. If they go through their regular run from a definite starting mark and a few minutes later start at the board running the other way, and are then able to hit the original mark with the jumping foot, that shows that they have run very evenly with uniform stride for two consecutive runs. As a rule it does not work and that is a very good demonstration to the beginner that they need a great deal of work in sprinting and uniformity of stride. Then it is not difficult to convince them that they should have considerable sprinting and considerable work over the low hurdles. If I have a boy that is small who cannot reach the low hurdles in the usual seven strides I move the hurdles. Instead of 20 yards apart I make them 16, 17, or 18 as the case might

require so that the boy is using his usual sprinting stride but is able to go over a low hurdle. From that basis we work tremendously over those given distances, taking off with his jumping foot and going over the hurdle. I find that it teaches body balance as well as uniformity of stride and also a certain amount of leg drive as he goes up in the air.

Types of broad jumpers have always intrigued me because I have found them from less than average height and more than average in weight to very tall and very slender boys, and in any of those extremes you may find champion jumpers. The world's record-holder, Jess Owens (Ohio State '37) and the boy that we had, Olsen (U. S. C. '36) were almost exactly alike in physical measurements. Olson did not succeed in reaching 26 feet but he came very close to it. He was a very good sprinter for forty yards. I have been fortunate in having a number of boys that were well over 25 feet and some of them approaching 26. In each case they had a splendid speed for at least forty yards, so I think the basis for all broad jumping is speed. Coach Hamil-

ton's jumper is a very deceiving runner. He does not look as though he is gaining a good amount of speed but in reality he is a very fine sprinter and so I think the basis of the whole thing is speed, and of

course there must be a letdown or a settling when the jumper leaves the board, in order to get up in the air. Coach Hamilton said that is one of the errors most common with the high school jumpers that they run right on down the runway and across the board without any settling or particular effort to get the jumping leg under the body as they leave the board.



Dean Cromwell, Southern California

I was very much interested in watching Ed. Hamm of Georgia Tech several years ago in his method of using his double check marks. He used a check mark around 90 feet and another one around the 42 $\frac{1}{2}$ or 43

foot mark, and Hamm emphasized that point where he almost executed a slight swerve in his run and putting his jumping foot down definitely on that last check mark then ran from there to the board. The idea of course was as Coach Hamilton said, there is no conscious effort made of getting the foot to hit the board properly. We have to have the jumper know that he is going to hit properly, without any question about it, all the effort being given to the jump. Most high school coaches are successful in having good jumpers by taking their number one sprinter and having him run down the runway and hit the board and jump. That is a very dangerous practice because jumping is tremendously hard on the legs. We use exactly the same method as the other coaches in having the runner get accustomed to the runway and hitting the check marks by actually giving them the work on the track. We have them gain practice in landing by having them land in the shavings of the pole vault pit or the high jump pit. I spend lots of my time keeping them away from the broad jump pit.

Usually a run of half the distance at half or three-quarters speed is sufficient for a jumper to get well up in the air and execute the proper form in the air and of course there is not a chance of their being afraid to land with the feet well out in front. So we work a great deal on those short runs in making an effort to get well up in the air. You all know that the opposite leg to the one of the take-off foot continues well up and out and that from that effort is where they get the lift and upward drive. If you can get the boy to execute an upward and forward drive you have accomplished a great deal toward the ultimate champion. Many years ago I used to put my high hurdles or standards about 12 or 14 feet beyond the take-off board and from these stretch across a string and have the jumper clear that in his broad jumping form. He was actually high jumping three or four feet but he was doing it with broad jumping form. I have since decided that that doesn't amount to much. We do it no longer.

You cannot emphasize too much the point that Coach Hamilton made of keeping the chest and head up because it is from that position that the runner gets up in the air. I think the definite settling of the body in making the effort to gather as they get off the board cannot be stressed too much. It seems to me that a great many runners are thinking of running instead of jumping and a great many jumpers are just thinking of the sprinting. There is actually a tremendous stamp given to the jumping foot as the take-off is made. Any kind of a bruise on the foot, any kind of injury on the ankle demonstrates very clearly what will happen if the jumper is not in the best of condition. Coach Hamilton's champion this year is a very, very fine example because he is a 25-foot jumper and an injury to an ankle cut that distance down very materially. A jumper must guard in every way against injury and I believe that it is one of the problems of the long jump to give the boy practice in jumping and at the same time not let him jump in a way that will injure him. For that reason only perhaps, it is a difficult event.

Coaches insist that nothing is gained by using the stride and a half or the hitch-kick as it is called when the jumper is in the air. I make no effort to have a

jumper use the hitch-kick if he is not accustomed to use it, and I certainly do not have them drop it if they have been accustomed to using the strides in the air. It is a decided benefit I think, to maintain balance in the air. It gives, I believe, added distance by having a boy do a very slight or modified stride and a half or hitch-kick as he is sailing. One of the best jumpers I ever had was Dick Barber, and he made no effort whatever at moving his legs in the air after he left the board. His entire effort was up and out—a very sound jumper. It might be interesting to tell you he is about the size of Ralph Metcalfe (Marquette '33) five feet eleven and weighing 160 pounds. He could stand a tremendous amount of work. You get some boys that are very slight, nervous and high strung and they need very little work. I have been accused of always underworking and never giving them enough to do but there was one boy that they could never give me criticism on and that was Barber the broad jumper because he did a tremendous amount of sprinting and he would run 300 yards with any one any time. He just craved speed and more speed, and more work and yet he was always good for a championship performance during his entire college career, and fortunately did his best work in the last meet as a senior.

This maintained the thing for which we all strive, and that is to have the boys improve as they go along, so that brings you down to the individual again. It is strictly an individual training question. Some of them needing a tremendous amount of training and especially a lot of work over the hurdles. I believe the one event that is of real benefit is working over the hurdles. Very early in my career I was fortunate in having a man that could sprint and low hurdle and broad jump. In one particular meet in which we were all keenly interested he won the low hurdles and went from that winning, with the thrill that came therefrom, over to the broad jump board where we had already marked off his run for him, he ran down the runway, smacked the board and out for the winning jump; thus in my beginning as a track coach I had the idea of this thoroughly imbedded in my mind that that was one of the finest things that there was because it was demonstrated to my satisfaction. A leg drive, body balance, and speed is all gained working over the

lows so that when we have coaching classes here I spend more time talking about low hurdles than any other one event, and I believe the running broad jump is the most benefiting event.

MR. TOOTELL: What kind of work do you give them during the competitive season?

MR. HAMILTON: We do quite a bit of low hurdling and a lot of sprinting and try to have them run and jump easily with perfect form if the boy needs it, and we let him play around a little in other events. At the University of California we have all the boys have a hobby event—something they are not interested in, except as a hobby. It may be the javelin or the low hurdles or something like that, so they spend time doing that. But mostly in the competitive season they run and play off the board from a few strides back, but never jump for distance. They do a lot of running though on the track as I have outlined, and that is about all.

QUESTION: Do you have any trouble with boys starting their gather too quick?

MR. HAMILTON: We allow about three strides. Olson, in my opinion, came the closest to any I ever saw, to maximizing the physical potentiality that nature had given him. I don't believe he jumped in high school at all. Possibly 21 feet, and yet I saw him jump over 25 feet nearly every time in his senior year. He didn't impress me as a boy that was too gifted by nature but a boy that had worked and mastered his technique. Olson, as I saw it, ran as hard as he could run all the way down and went off that board with a lot of power. The other extreme gives you a boy like Watson of Michigan who can run very fast. Then he apparently loosens up so he can control his jump. The gather, as Dean said, happens about three strides prior to the take-off. Some boys run and grunt and still keep under control. Most of them have to run about 99% as fast as they can go but not quite so fast as they can absolutely run because if they do they can't control their jump. But Olson just kept on going full speed and still controlled his jump.

MR. JONES: What is your method of teaching the gather?

MR. HAMILTON: We shorten the last

stride a trifle and relax the body just as you do in gathering for the hundred. It is the same principle. Our last stride off the board is a short stride, almost imperceptibly short. Shorter than the other but they go off that board as though they had just reached back and were hitting it, the body well forward.

QUESTION: Do you say anything about the position of the feet in landing?

MR. HAMILTON: You have them land every which way. Some of them land and then turn. We spend some time with them in that. I never had a boy that couldn't brace his knee and go forward.

MR. JONES: Don't you feel that the best way of teaching the gather is to drop the arms in the last two strides?

MR. HAMILTON: That would do it. Yes.

MR. OLSON: For years I have heard about shortening that last stride and I wonder if any coach has actually measured that distance exactly. What is the difference between that stride and the one before it?

MR. HAMILTON: About four inches, I would say. That is about the average.

MR. CROMWELL: I have them vary as much as one foot. Others didn't vary at all. They were settling and relaxing but their stride remained the same. That is your individual question again.

A STUDY ON THE EFFECTS OF THE USE OF ALCOHOL AND TOBACCO

RALPH METCALF: I think we are all directed along one particular line and that is the optimum physical development of our athletes. I have been interested in the physiological angle more so than the technical side. I look at it like this. That a boy must come to coaches pretty well developed and at the same time must continue to develop along the proper lines. Otherwise, all the finest and most advantageous advice that coaches can give would be of no avail. For this particular reason I became interested in the study of the effect of alcohol and tobacco on the athletes' performance. Quite a few of us have gone overboard. Some of us absolutely won't tolerate it. Others say a cigarette may relax you, and the same with beer. For that

reason I thought we should be arriving at some uniformity of opinion on the matter, whatever it might be. If a cigarette won't hurt the athlete, and a glass of beer won't do him any harm, why not allow him to have them? Of course I realize that quite a few of the institutions have ideals and principles and of course you just can't come out and say what you think. On the other hand, if one cigarette adversely affects a boy and if one glass of beer or glass of wine or high ball adversely affects him, let's all join our forces and try to encourage this boy not to get in the habit, or if he is already in the habit, to encourage him to be more interested in his athletic development.

I personally don't believe we can accomplish this particular purpose through coercion. I think it is a matter of confidence and a matter of interest on the part of the boy with the coach and for that reason the coaches must be well stocked with arguments and reasons. I mean by that they must not have no reason for asking the athlete to refrain. True enough, when I was competing I was often told, "Don't smoke and don't drink." I didn't ask why but I find this: that we are competing against one thing and that is outstanding; it is smoking and drinking in the presence of the younger men. Naturally the older ones are the youngers' ideals and what we try to tear down they seem to build up or vice versa.

I really won't have time to go into my complete studies. It includes about 128 typewritten pages not to mention the appendix, but I would like to tell you coaches and trainers that I got my material from all the reading sources that I could find in the library here and other studies that have been made through medical journals, etc., and questionnaires. I sent out 150 questionnaires to coaches and trainers. Similar questions I have sent out to another group of

physical educators and physicians. And another group of only fifty selected athletes. These I sent to because I knew them personally and knew that they had confidence in me to give me the authentic information I wanted. I want to read a few notes here that I have. I am really not satisfied with the material that I have because I don't think it does justice to the study. We are trying to find out just what the effects of alcohol and tobacco are on the athlete's performance. We must have a scientific reason for saying this. If these facts are convincing enough we will have good results.



Ralph Metcalfe

The purpose of this study is four-fold: To better train, at least to reach highest physical perfection; to benefit all who have influence over athletes, namely,

the coaches and trainers and physical educators and parents; third, from the educational point of view, to elicit better cooperation between coaches and athletes. It was found out that alcohol in its pure form is seldom if ever taken in, but is broken down into beverages. These drinks to be intoxicating must have alcohol in them. In other words, the content of alcohol determines the potency. It was found that beer contained from 1 per cent and 2 per cent to 7½ per cent of alcohol. Wines from 7 per cent alcohol to 14.3 per cent. Spirits, we have rum, brandy and whiskey. Rum and brandy about 50 per cent alcohol. Brandy is from 48 to 54 per cent alcohol. Whiskey is from 43 to 53 per cent alcohol. Of course without alcohol a drink is no longer intoxicating and is known as a soft drink. The effect of the beverages upon the body depends upon the amount taken. If you take beer you can't expect the results to be as harmful as a glass of gin or a highball. Dr. Gould found that alcohol up to two ounces could be used or burned in the body without any definite detrimental effect, but even these two ounces are shown to be more or less deleterious to the body tissues themselves. All over two ounces is definitely known to in-

jure the organism. The rate of absorption of alcohol in the blood and organs is rather rapid; more so than the elimination. The maximum amount of alcohol found in the blood occurred between one-half and two hours after ingestion. Alcohol is evenly distributed throughout all the bodily tissues. The concentration of alcohol found in the blood always depends on the rate it is imbibed. In other words, if you take a drink now and a few moments later take another drink, that alcohol is being eliminated slowly from the system. Don't get the impression that it is coming right out because it is not. But of course if you just keep drinking and drinking before the system can oxidize this alcohol in the body, naturally the effect is going to be more harmful.

Concentration of alcohol in the blood always depends upon the rate it is imbibed. The longer interval between the drinking the less effect it has upon the bodily tissues. The physiological effects of alcohol are greater when taken on an empty stomach, which brings into mind the idea that drinking will help digest food. With some individuals it might help, with others it has a definite opposing influence upon digestion. Some people take a highball to stimulate appetite. The brain, heart, lungs, kidney, spleen, and muscles of the skin all take up alcohol from the blood. A small portion of alcohol is eliminated through the lungs and kidneys. The amount of alcohol excreted is only a small portion of that ingested. The other portion of unoxidized alcohol is eliminated through the lungs in that air which is exhaled. I came to this conclusion: That an athlete training, provided he doesn't want to reach the maximum physical development, can eliminate alcohol from his system faster than the average person living a sedentary type of life. However, I want you to keep in mind that there is a definite effect on the body tissues. He won't reach the maximum physical efficiency. Haven Emerson, who is an authority on the effects of alcohol, found that moderate amounts of alcohol require about twelve hours to complete elimination; one drink or two, that is. It depends upon the individual, however. Of course excessive amounts of alcohol may require more than one day.

One doctor stated that the reason for the difference in individuals being able to take more and hold it better is probably due to the thickness of the cortex

of the brain. If the cortex is rather thin, he is the type of individual that can't take very much alcohol, and one drink makes him woozy. On the other hand an individual who has a thick cortex will probably be able to imbibe more. The individual differences makes it difficult to estimate the extent that a person may take alcoholic beverages without harmful or apparently harmful results. Some people have said, "I may well be criticized by you for taking a drink but I notice you get yours through the sugar that you eat." It is purely a matter of rationalization. To use alcohol for a food so much would have to be taken that it would be detrimental to the tissues themselves. In other words, the amount of food value in alcohol is so small, a large quantity would be required in order to take enough to get much food value.

Alcohol has a definite effect upon the heart. It speeds up the heart from eight to ten beats per minute during the period of the concentration of the maximum amount of alcohol in the blood. The idea that alcohol aids in the kidneys' function is purely erroneous, it was proven in one of the studies. In fact, it put more of a weight on the kidneys. Large amounts of alcohol tend to depress the respiratory center and increase the rate of assimilation in the tissues. The tissues of the nervous system are greatly affected by alcohol. It is well to keep in mind that alcohol does not affect the muscles directly. It affects the nerves first and these corrupt the muscles. Alcohol has nothing to do other than probably to take the place of some food and preventing the muscles from getting the good food. It is through nervous control that the effects are more pronounced.

In regard to tobacco it is quite interesting to note that in the questionnaire, one of the questions was, "Which of the four forms of tobacco is the more harmful?" (Cigarettes, cigars, pipes, and chewing tobacco), authorities were at a difference in regard to the most harmful. Some said cigarettes, some said cigars. The degree of harm of any tobacco depends upon the poisonous content. It really is that. Nicotine, pyripine, strichine and other harmful ingredients are contained in all tobaccos. The most concentrated would be the most harmful. The difference between the cigar and cigarette is this: if the cigarette smoke

is inhaled it reaches the lining of the lungs and is absorbed into the blood system at a faster rate than the cigar. However the cigar is seldom inhaled. As it reaches the lungs and blood system there is where the effect upon the nervous system occurs. The pipe is quite harmful depending upon the strength of the tobacco. If you smoke a cigarette that is wet you get more nicotine than if you smoke a dry one. Another interesting thing to note in cigarette smoking, it is not how many cigarettes you smoke, it is how far down you smoke each one. Nicotine seems to come toward the butt of the cigarette. Sometimes you hear individuals say they want the last draw from a smoked cigarette. That is because they like the nicotine effect of it. For that particular reason they smoke their own cigarettes way down to the end. To have less effect you smoke the cigarette far less.

Tobacco, like alcohol when first used has a great effect upon the nervous system which often brings about dizziness and nausea. These symptoms are often apparent in individuals who have stopped smoking and again start the habit. I don't know how many of you stop smoking and start again, but I think you all realize that there is a definite readjustment that the nervous system has to make. The system never gets adjusted to tobacco, no matter how much you smoke. This may be attributed to the fact that tobacco is not a natural food. Its effects are toxic and not tonic.

If the nicotine has been removed from the cigarette, the average smoker doesn't seem to care for it. In connection with that, a study was made with regard to the use of cigarette holders. It was found that cigarette holders in which there was one cigarette inside of the holder, cut down the nicotine and harmful ingredients 50 per cent in each cigarette smoked. In some holders in which you have two cigarettes acting as filters it was found that 78 per cent of the nicotine was cut down. There is one disadvantage in this. That is that quite a few smokers found that they smoked more cigarettes than they did before, because they didn't get the satisfaction of the nicotine from each cigarette smoked. About 75 per cent of the nicotine in the cigarette remains in the smoke after combustion. The amount of nicotine absorbed into the body depends upon the amount of nicotine originally in the to-

bacco, the moisture of the tobacco, the number of puffs taken of a cigar, cigarette or pipe, and the number of puffs taken in proportion to the length of the smoke, and whether the smoke is inhaled or not. All these are influential factors. Dry cigarettes are easily combustible and lose more nicotine (by evaporation) than moist cigarettes.

Another thing about smoking, in regard to inhaling—some individuals don't inhale as deeply as others. Those who study respiration know that there are various phases of breathing. The middle phase of tidal air, and the stage just below that. The deeper you breath, the more opportunity there is for the nicotine to be absorbed into the system, and some of them hold the smoke in the lungs for a longer time and more of course is absorbed. All these are deciding factors in smoking. Nicotine enters the system from the lungs and nose and mouth and some is deposited in the skin from within. It has been found that when some heavy smokers perspire, there is a brownish coat on the skin. One of the coaches here at USC, when he was discussing with me whether there were any smokers on his team, said there were none. I questioned it and he said, "How do you know?" I said I could tell by the color of a certain boy's skin. There is a definite change in the skin of the heavy smoker.

Nerves are first stimulated by the nicotine and later depressed. The respiration becomes rapid and the heart has an abnormal rhythm. These symptoms are indicative of poison in the system. The carbon dioxide is stored in the blood. Lactic acid, which is then normally produced in difficult to eliminate through the lungs. This condition produces shallow breathing, a constriction of the respiratory muscles. It is well to keep in mind just how these factors affect the athlete. I failed to mention before that very little material is available as to the actual effects of alcohol or tobacco on athletes in particular. The general studies are on the effects on a normal individual, not on the athlete who leads an active type of life. These effects I had to transfer to and apply to athletes. An athlete has to be in better physical condition than the average individual. The heart rate is affected by tobacco, just like alcohol. It is speeded up, which throws you off the natural rhythm of your heart beat. There is no proof that

tobacco aids in digestion. It does tend to diminish the appetite for food if used prior to breakfast. I have discussed that with smokers. They say that if a cigarette is smoked before breakfast their appetites are smaller than ordinarily. That would go contrary to the development of athletes.

I am going to consider now the data compiled from the questionnaires I sent out. The data was presented in three chapters. I have combined coaches and trainers in one, physicians and educators in another and athletes in still another. Each question is treated separately. I quoted some of the answers but did not quote any of the names for the reason that I didn't want anyone to question those who wrote and I wanted authentic information purely. The majority of opinion was similar to the combined reading material on the effects of these drugs. The following facts were brought out: Both alcohol and tobacco affected the nervous system most, which in turn affects other parts of the body. Alcohol does not affect the muscles but did exert a strain on the heart, lungs and kidneys. The amount deleterious depends upon the alcohol contained in the drinks and the poisons in the smokes actually taken into the body. Beverages with a high alcoholic content, such as gin, are more harmful than drinks such as beer and wine. Cigarettes are more harmful, if inhaled, than any other form of tobacco. Cigars are harmful because more poison is in the smoke. But both alcohol and tobacco are deleterious to children because they are immature. It is well to remember that particular point because of the effect they have on the vital organs.

People who start smoking and drinking cause others to do so. I was interested to find why youngsters start smoking. Some, including athletes, stated that they started smoking and drinking more or less to be sociable and because others did it. I don't think that is a very good reason but they still do it. From the opinions and material found it was deducted that both alcohol and tobacco are harmful and should not be indulged in whether mature or immature. Both drugs are contrary to the normal development of the body while training. Poison and tobacco smoke enters the blood stream and stops necessary production. A lack of coordination results. Waste products thus interfere with the normal processes of elimination. This causes the

heart to speed up. Alcohol stimulates the heart by exciting the nerves. The kidneys are placed under a burden to eliminate alcohol. It retards the sensory and motor function which control the lower parts of the body causing poor co-ordination and weakens the general structure. I recommend to athletes that the effects of tobacco and alcohol were proven to be detrimental to the athlete. One cigarette may throw off an individual's nervous system and put it into discord, and I think all of you know that coordination is more or less determined by the muscle stimulus that is given. Our muscles only act through stimulus, so when the nerves are affected the muscles are in turn affected by their movements. The athlete should weigh the advantages and disadvantages of the use of these two different drugs. The coach, trainer, teacher, physician, and parent should all instruct boys of the harmful result of the use of alcohol and tobacco. After the season if he wants to smoke he should not do so in the presence of youngsters who look up to them. I think that it is quite important in trying to fight the idea of using alcohol and tobacco. We always have to remember that youngsters are immature and do not fully see the benefit of refraining from their use, and we must direct and guide them. It was proven definitely that neither alcohol nor tobacco gave any particular help in any particular way. For that reason I cannot see why an athlete should indulge in the use of either one. (Applause)

MR. TOOTELL: Thank you very much, Ralph.

In these meetings we usually give some attention to changes in the rules which our members would like to suggest. We are not, of course, a governing body, but some very good suggestions to the Rules Committee have come out of our discussions. Have you gentlemen any particular suggestions to make?

(Here followed a brief general discussion on several points intended to clarify or otherwise improve the present track and field rules of the N. C. A. A.)

MR. TOOTELL: One other thing should be considered before we get into the business end of this meeting. This has to do with the best time for us to meet. For many years we have had our meetings cover all of one day. This year

we scheduled two morning sessions because we thought some of you boys would like to be out on the field with your men in the afternoon. It has been something of an experiment to see which arrangement is the more convenient. I want to find out if you prefer to continue it this way or have our sessions during the morning and afternoon of one day (put to a vote, the members indicated by a large majority a preference for a one-day session.)

MR. HANNER: Next year I should prefer to have this meeting at some hotel downtown wherever the meet happens to be held so it will be closer to the places we are staying. I am sure a more convenient meeting place can be arranged. (many ayes)

MR. TOOTELL: I wish to thank the speakers this year for their promptness in responding to my request for their appearance on the program. I should like to ask one more thing at this time. It may be a little difficult but I think we could arrange to have a mid-winter meeting at the time of the annual N. C. A. A. Convention in December. What do you gentlemen think of an attempt to meet next Christmas week? Or, do you think this should be worked out by our executive committee?

MR. OLSON: I think it would be a fine idea.

MR. HAMILTON: I doubt that we should be able to get a quorum.

MR. OLSON: I don't know what kind of a quorum is necessary, but I know that we have had some interesting gatherings during Christmas week at other times, and if I can get to the N. C. A. A. Convention I'd like to sit in with a bunch of you fellows.

MR. HANNER: I should like to suggest that the advisory committee come to some conclusion about it and advise the members.

MR. TOOTELL: It is so ordered.

(Following reports of the secretary-treasurer and the advisory committee, the report of the nominating committee for officers for the ensuing year was accepted by vote. Officers thus duly elected for 1939-40 are:

President—Karl Schlademan, Washington State College.

Vice-President—Larry Snyder, Ohio State University.

Secretary-Treasurer—F. P. Johnson, Drake University.

Members of the advisory committee:
For one year—Frank Hill, Northwestern University; E. E. Hayes, Indiana University.

For two years—Harry Adams, University of Montana; Charles Hoyt, Yale University.

For three years—Ralph Higgins, Oklahoma A & M College; Frank Potts, University of Colorado.

(Secretary's note: The National Collegiate Cross Country Coaches Association was formed in November, 1938, at the time of the Second Annual National Collegiate Cross Country Championships, held at Michigan State College, Lansing, Michigan. At the meetings of this group in 1938 and 1939, Mr. Sid Robinson, of the Department of Physiology, University of Indiana, presented two papers of considerable merit and of much interest to the coaches assembled. At the suggestion of Mr. T. E. Jones of the University of Wisconsin, these papers, re-written to be included in these notes, are here presented.)

ENERGY AND FATIGUE IN DISTANCE RUNNING

by
SID ROBINSON
(1938)

A man's ability to sustain severe work is limited by: (1) The oxygen supply to the muscles during work, (2) The oxygen debt, (3) Fuel available for supplying energy, (4) Efficiency or skill in carrying out the work, (5) Control of body temperature. The relative importance of each of these factors depends upon the duration and severity of the work and upon the environmental temperature and humidity. In middle distance running the problems of skill, oxygen debt, and oxygen supply to the muscles are the dominant ones. The energy which is available for carrying on a race of two to four miles is derived principally from oxidation (burning) of muscle glycogen (carbohydrate) during the run. Since the re-

serve glycogen in the body of a well-nourished athlete is usually more than adequate to carry out a race of this distance, the principal limiting factors here are the supply of oxygen for burning the glycogen and the efficiency with which the available energy is expended during the run.

The oxygen supply to the muscles under these circumstances is dependent upon a well developed heart and circulatory system, because oxygen is transported by the blood from the lungs to the muscles. In fast running the oxygen supply is not adequate for the large amount of energy needed because the heart cannot pump enough blood. When the muscles are forced to work without an adequate supply of oxygen, thereby building an oxygen debt, the energy can be supplied temporarily by the breakdown of glycogen to lactic acid. However, when the accumulation of lactic acid reaches a physiologically high level, the runner becomes fatigued or "ties up" as the coach expresses it. In "tying up," associated with accumulated lactate, there is a decrease in the contractile power of the working muscles and a less effective coordination of movement. This "lactic acid mechanism" will supply a definitely limited amount of energy which must be paid back by oxidation after the race is over. Thus the runner incurs an "oxygen debt." Outward evidences of the "oxygen debt" after a race are that a runner's breathing remains fast and his heart rate high for a considerable time.

From these statements it will be seen that the total amount of energy available for a given middle distance race is that for which a runner can supply oxygen plus that for which he can go into oxygen debt. Since for an individual runner the available oxygen debt would be about the same in any race from a half mile to five miles, the relative importance of the oxygen debt as a source of energy would decrease with the increasing distance of the run. For example, during a mile run lasting about $4\frac{1}{2}$ minutes a man might consume a total of 18 to 20 liters of oxygen and have an oxygen debt of about the same magnitude; in a two-mile run lasting $9\frac{1}{2}$ minutes the same man would consume more than twice as much oxygen and yet his oxygen debt would be no greater than in the mile. It is probable that a good training program continued for several years improves the efficiency of the circulatory system and thus increase the rate

of oxygen supply. The utilization of the oxygen debt to the fullest extent in a race, associated with accumulating lactic acid, depends upon the runner's willingness to extend himself, principally during the latter half of the race.

Training probably does not increase the available oxygen debt but it will help to develop confidence and determination of a runner in tolerating a high lactic acid oxygen debt. It is probable also that the efficiency of a trained runner is not so greatly affected by lactic acid as is that of an untrained man. Coaches have found in practice that excellent conditioning work for runners of all distances is the repeated running of short distances at a fast rate with special attention to form. The runs are repeated after short intervals before recovery from the preceding run has occurred. The scientist has found that a man will accumulate a higher lactic acid in this type of work than he can in a sustained run of the same total distance; thus the coach is schooling his men in tolerating high lactic acid and yet holding good form.

Since for a given race a runner's available energy is definitely limited, his success depends also upon the economy or efficiency with which he expends this energy. Economy depends upon good form or muscular coordination which can be improved by training. Experiments have been performed which indicate that the most economical way to run a race is to run at a reasonably even pace, (first quarter of the race, second quarter, third quarter and fourth quarter of the entire distance) and practical experience bears this out. For instance, if the first quarter-mile of a mile or two-mile race is run too fast a runner may acquire most of his oxygen debt and be forced to run the remainder of the race with a high lactic acid. In addition to the feeling of fatigue which would tend to discourage the runner throughout the race, his efficiency would be decreased by the high lactate. The reader should recall that as lactic acid accumulates the coordination of the muscles becomes less effective and there is a decrease in contractile power of the muscles. Both of these factors contribute to lowered efficiency and thus when a man runs most of the race with a high lactic acid he must run at a slower pace since he cannot go beyond his definitely

limited energy supply for completing the race.

The fuel for muscular work is glycogen (carbohydrate) and fat. When both fat and glycogen are available the muscles show a preference for glycogen but both are utilized for work. When glycogen is being burned for energy the mechanical efficiency of the body in doing work is greater than when fat is used. For this reason it is well to have a good glycogen reserve in a runner and to this end his diet in the 36 hours preceding the race should contain plenty of carbohydrate. It is well to keep in mind that the general diet should include an adequate supply of the other essential foods. In races up to 30 minutes duration we have no evidence to prove that a runner's glycogen reserve is seriously depleted when he is in good condition. The glycogen reserve may in some cases be seriously depleted in a marathon. In this case the runner's muscles must shift more and more to fat as a fuel and thus the mechanical efficiency gradually falls. Since marathon runners finish their races with very little rise in lactic acid it follows that their principal limiting factor is the fuel supply rather than a limitation of oxygen supply and therefore the feeding of dextrose during the race should be of much benefit. A good carbohydrate reserve is important in all athletics especially where the exercise is prolonged or where a man runs several races on the same afternoon.

In addition to the energy which appears as external work, part of the energy expended by a man during exercise is used by the heart, respiratory muscles, etc. But, even taking this into account, a large fraction of the energy set free in the body during exercise is changed into heat and must be lost through the skin and lungs. The loss of heat, however, does not quite equal its production, and the temperature of the body rises until a balance is reached at a higher level. The extent of the rise in body temperature depends upon the severity of the exercise and the temperature and humidity of the environment. Increase in body temperature favors the velocity of chemical reactions and diffusion and thus may significantly increase the rate of lactic acid removal in the body. In cool weather middle distance and distance runners are probably not greatly hampered by the burden of heat elimination during a race. In very

warm humid weather the heart is burdened with the dual job of circulating blood to the working muscles as well as a much larger flow of blood through the skin in heat elimination.

Since these things are true, an aspiring middle or long distance runner can improve his performance by using these practical suggestions:

1. Learn to judge pace and acquire the ability to run at an even pace throughout the race in order to keep lactic acid at its lowest level during the first three-fourths of the race.
2. Build up glycogen (carbohydrate) reserve because it greatly determines the amount of endurance in a race. See that the diet contains a liberal supply of carbohydrates, especially during the 36 hours preceding a race.
3. A long distance runner (12 miles or more) may increase his efficiency by eating dextrose during the latter part of a race.
4. Remember that in middle distance running the oxygen debt supplies a large fraction of the energy available. It has been found (by actual measurement of lactic acid) that very often the runners who are in front at the end of a race are really more tired than those who are far behind. From this we know that had they been willing to extend themselves, some of these slower boys might have been among the winners.

SOME PHYSIOLOGICAL ASPECTS OF DISTANCE RUNNING

by
SID ROBINSON

(1939)

Among the chief limiting factors of a man's ability to run races from one to six miles are the oxygen supply to the muscles, the oxygen debt, skill, and the control of body temperature.

Any work performed by the body involves an expenditure of energy. This energy is derived from the breakdown of adenylylpyrophosphate and phosphocreatine. These reactions do not require oxygen. In order to continue the work for any considerable length of time energy from some other source must be put into recombining phosphoric acid and creatine into phosphocreatine. The energy needed for this may be derived from two

sources; (1) the oxidation (burning) of fuel, and (2) the breakdown of glycogen to lactic acid, another reaction which does not require oxygen. Thus the muscles can work for awhile without any energy derived from oxidation, but soon the lactic acid accumulates and the strength of contraction and coordination of the muscles decline. The lactic acid diffuses freely into the blood and is distributed to the remainder of the body. This tends to delay its concentration in the muscles and thus increase the total amount which the body can tolerate. Since it is an acid, it lowers the alkaline reserve of the body. In order to restore the body the lactic acid must be removed by energy derived from oxidation of fuel. About four-fifths of the lactic acid is changed back to glycogen by energy derived from oxidizing the other one-fifth, or its equivalent in other fuel. The amount of oxygen required to restore the phosphocreatine and glycogen after work is greater than the usual resting requirement; this excess is known as an "oxygen debt." In actual practice all of these processes go on simultaneously when a man is doing such severe work as running a mile or two-mile race. His circulatory system is supplying oxygen as rapidly as it can possibly do so, yet competition drives him to expend energy more rapidly than his highest oxygen supply can give it so his lactic acid mechanism is brought into play and he acquires an oxygen debt. He pays this debt by taking in extra oxygen after work ceases. The outward evidences of the oxygen debt after a race are that the runner's breathing remains fast and his heart rate high for a considerable time. Thus it will be seen that the total amount of energy available for a given middle distance run is that for which the runner can supply oxygen plus that for which he can go into debt. The oxygen debt as a source of energy for work may not exceed 15 to 20 liters of oxygen and it would be the same regardless of the distance in races from one to six miles. The utilization of the oxygen debt to the fullest extent in a race, associated with accumulating lactic acid, depends upon the runner's willingness to extend himself, principally during the latter half of the race.

Training probably does not increase the available oxygen debt but it will help to develop the confidence and determination of a runner in tolerating a

high lactic acid oxygen debt. It is probable also that the efficiency of a trained runner is not so greatly affected by lactic acid as is that of an untrained man. Coaches have found in practice that excellent conditioning work for runners of all distances is the repeated running of short distances at a fast rate with special attention to form. The runs are repeated after short intervals before recovery from the preceding runs has occurred. Edwards found that a man will accumulate a higher lactic acid in this type of work than he can in a sustained run of the same total distance; thus the coach is schooling his men in tolerating high lactic acid and yet holding good form.

It is well to keep in mind that even though a runner does have the adenylylpyrophosphate, phosphocreatine and lactic acid mechanism as a temporary source of energy in emergencies oxidation of fuel must ultimately restore the energy.

The oxygen intake during the run depends upon a well developed heart and circulatory system because oxygen is transported by the blood from the lungs to the muscles. Each 100 cc. of blood will carry from 20 to 22 cc. of oxygen, of which 50 to 70 per cent may be utilized as the blood passes through the tissues. Experiments have proved that the lungs can easily be ventilated in excess of the highest ability of the blood to take up the oxygen from them. Thus in the final analysis, the oxygen supply is limited by the ability of the heart to pump blood.

The maximal oxygen supply during exhausting work of a champion runner far exceeds that of a non-athlete of the same age. For instance, Don Lash can supply 5.35 liters per minute or 82 cc. per kilogram of his body weight, and the average young man of his size about 3.2 liters or 50 cc. per kilogram. In a 20-minute race Lash could have an oxygen supply of 5.35×20 or 107 liters plus an oxygen debt of 15 liters—a total of 122 liters of oxygen for energy. The average non-athletic young man would have a total of about 79 liters of oxygen to use for a 20-minute run. For the champion to run a race lasting four minutes, the oxygen debt would be about 15 liters and, when added to the oxygen supply of about 20 liters, bring the total to 35 liters of oxygen available for the race. From this we see that the oxygen debt

is of greater importance in the shorter runs.

The mechanism for this larger oxygen supply in the runner lies chiefly in a better development of the heart, bringing about a greater output of blood per minute. When a champion distance runner is doing moderate work such as rapid walking, his oxygen requirement is about the same as a non-athlete but he can supply the blood for transporting the oxygen with a heart rate of 100 to 110 as compared with an average rate of 142 in non-athletic young men. This means a more powerful and efficient heart, ejecting more blood per stroke. In a grade of work which exhausts the average young man in four minutes, his heart rate reaches about 190 beats per minute while the champion doing the same run has a heart rate of 160. When the champion makes a run which will really exhaust him, his heart rate attains the same maximal level as the non-athlete's. In order to make a higher oxygen intake possible in this exhausting work the champion's heart must put out more blood per minute than the non-athlete's. The larger output of blood from the heart in a champion runner under these conditions is therefore due to a greater output per beat since the maximal rates are the same.

We have no evaluation of the relative importance of training and inherent qualities in the development of this great oxygen supply in distance runners, but it is probable that both factors are essential. If certain inherent qualities were not essential, then the champion's performances might well be equalled by any enthusiastic youth who is going through the same training program. It is probable that a good training program continued for several years improves the efficiency of the circulatory system and thus increases the rate of oxygen supply.

Since for a given race a runner's available energy is definitely limited, his success depends also upon the economy or efficiency with which he expends this energy. Economy depends upon good form or muscular coordination which can be improved by training. A. V. Hill has found that the total energy or oxygen requirement for running a given distance increases as the 2.8th power of the speed. Lupton has found similar changes in efficiency in stair-climbing when the rate of stepping exceeds an optimum.

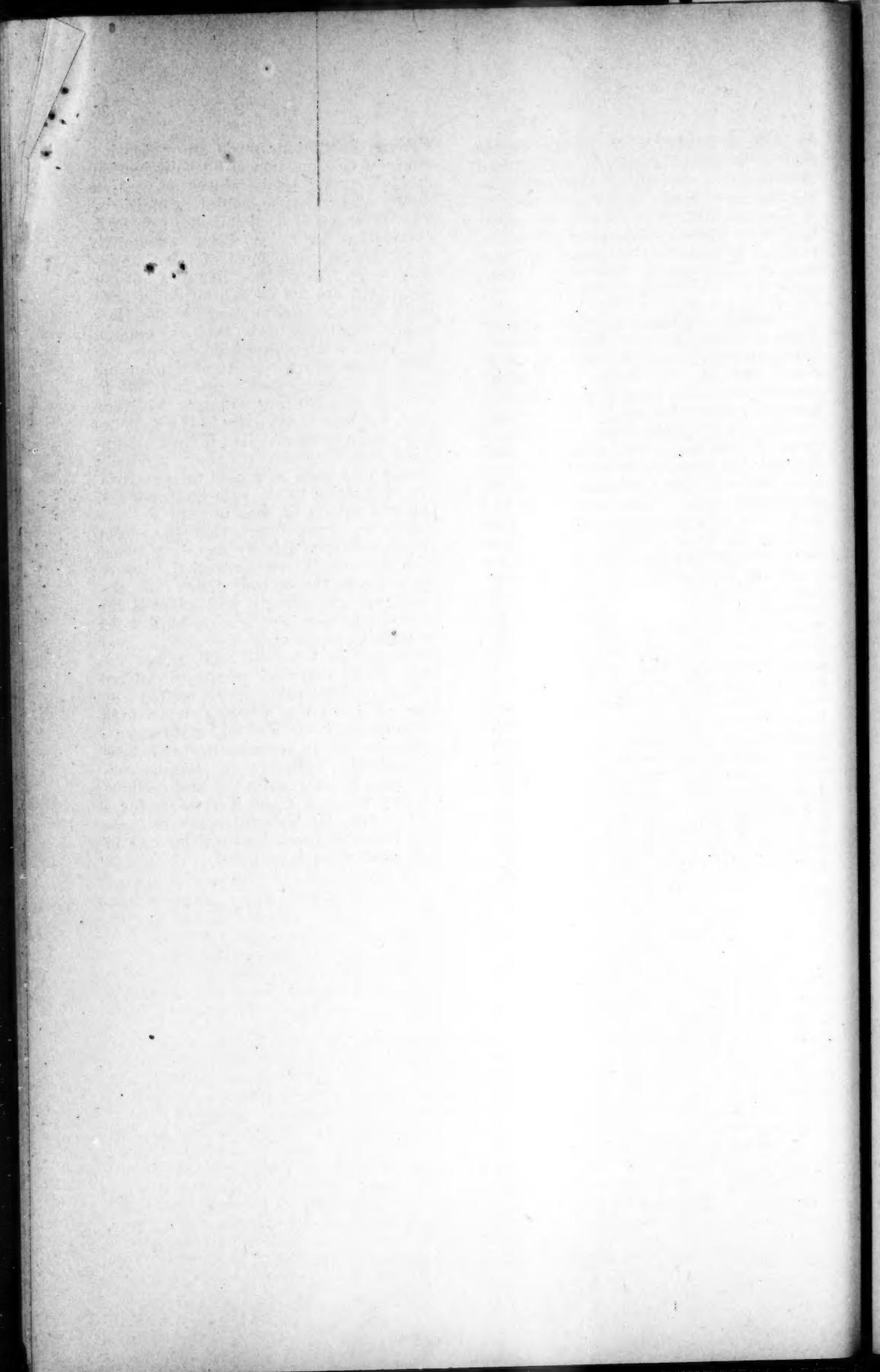
Since the oxygen requirement increases so greatly with increasing speed, Hill concludes that the most efficient or economical way to run a race is to run an even pace because any part of the race run above the average speed requires more extra energy than can be saved in another part run at a correspondingly slower rate. For instance, if the first quarter mile of a mile or two-mile race is run too fast a runner may acquire most of his oxygen debt and be forced to run the remainder of the race with a high lactic acid. The fact that he is expending energy too rapidly during the period before his oxygen intake reaches its maximum also contributes to this. In addition to the feeling of fatigue which would tend to discourage the runner throughout the race, his efficiency would be decreased by the high lactate. The reader should recall that after a certain amount of lactic acid accumulates, the coordination of the muscles becomes less effective and there is a decrease in contractile power of the muscles. Both of these factors contribute to lowered efficiency and thus when a man runs most of the race with high lactic acid he must run at a slower pace since he cannot go beyond his definitely limited energy supply for completing the race.

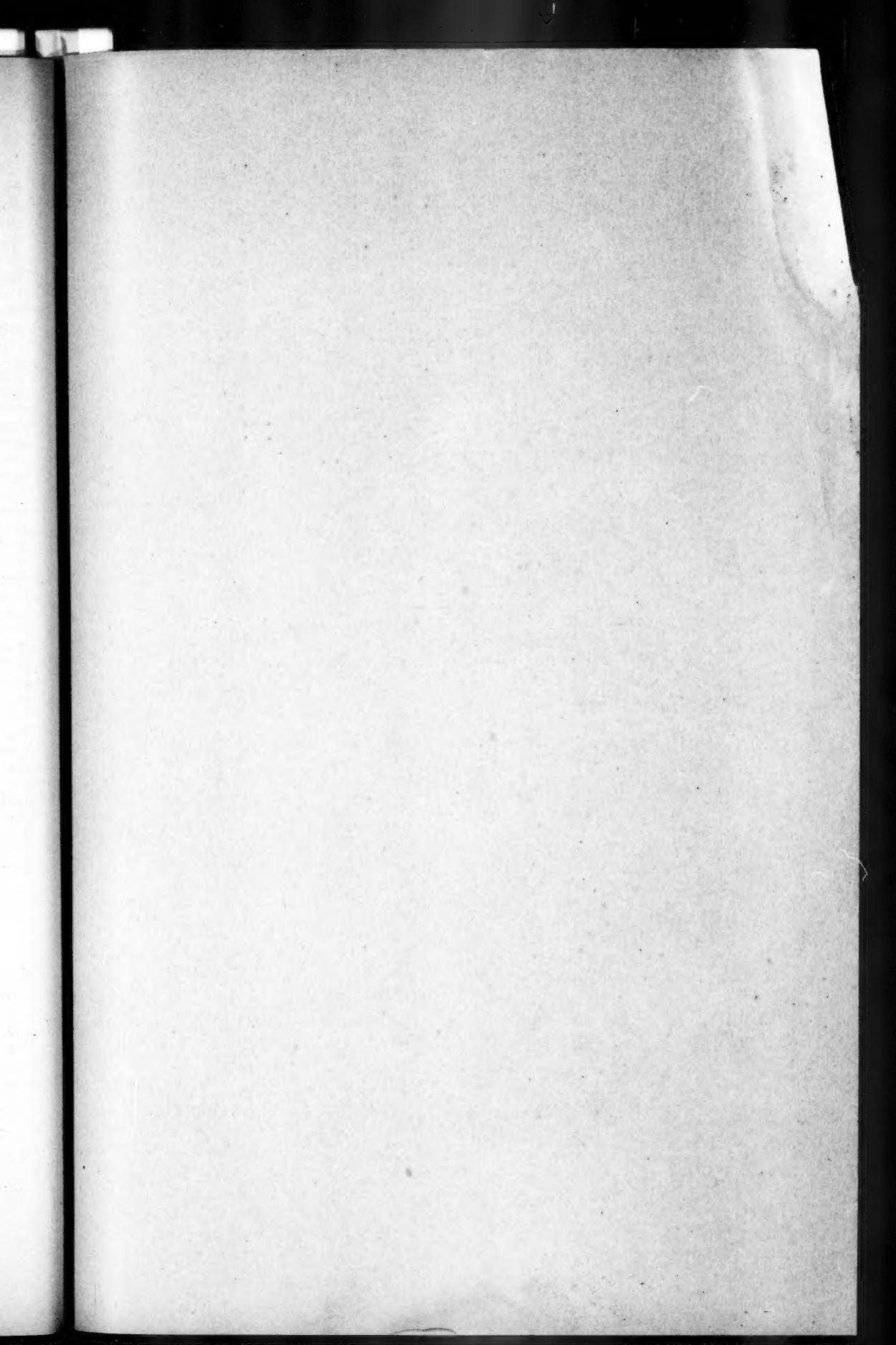
The fuel for muscular work is glycogen (carbohydrate) and fat. When both fat and glycogen are available the muscles show a preference for glycogen but both are utilized for work. When glycogen is being burned for energy the efficiency of the body in doing work is greater than when fat is used. In burning glycogen the body secures more energy from a liter of oxygen than when it burns fat. For this reason it is well to have a good glycogen reserve in a runner and to this end his diet in the 36 hours preceding the race should contain plenty of carbohydrate. It is well to keep in mind that the general diet should include an adequate supply of the other essential foods. In races up to 30 minutes' duration we have no evidence to prove that a runner's glycogen reserve is seriously depleted when he is in good condition. The glycogen reserve may in some cases be seriously depleted in a marathon. In this case the runner's muscles must shift more and more to fat as a fuel and thus the efficiency gradually falls. Since marathon runners finish their races with very little rise in lactic acid it follows that their principal lim-

iting factor is the fuel supply rather than a limitation of oxygen supply and therefore the feeding of dextrose during the race should be of much benefit. A good carbohydrate reserve is important in all athletics especially where the exercise is prolonged or where a man runs several races on the same afternoon.

In addition to the energy which appears as external work, part of the energy expended by a man during exercise is used by the heart, respiratory muscles, etc. But, even taking this into account, a large fraction of the energy set free in the body during exercise is changed into heat and must be lost through the skin and lungs. The loss of heat, however, does not quite equal its production, and the temperature of the body rises until a balance is reached at a higher level. The extent of the rise in body temperature depends upon the severity of the exercise and the temperature and humidity of the environment. Increase in body temperature favors the velocity of chemical reactions and diffusion and thus may significantly increase the rate of lactic acid removal in the body, according to Bock and Dill. In cool weather middle distance and distance runners are probably not greatly hampered by the burden of heat dissipation during a race. In very warm humid weather the heart is burdened with the dual job of circulating blood to the working muscles as well as a much larger flow of blood through the skin in heat dissipation. To test this out our laboratory in collaboration with the Harvard

Fatigue Laboratory made an extensive study of the question of heat dissipation in high humid temperatures as well as under other environmental conditions. The influence of acclimatization on heat elimination has also been evaluated. Persons who spend most of the time indoors even though they live in a hot environment are not capable of doing hard work in a hot environment because they cannot eliminate heat rapidly enough and soon reach exhaustion because the body temperature rises to an intolerable height—in some cases exceeding 104° F. Persons who during summer weather work for long hours daily in the heat become much more efficient in heat elimination than they are if they suddenly plunge into work in a high temperature. The circulation to the skin improves and Dill and others of the Harvard Fatigue Laboratory have found that the sweat glands conserve salt by secreting sweat with lower salt concentration. Negro workmen in the cotton fields of the South are exceedingly well adapted for heat elimination. Performing hard work by walking at 3.5 m. p. h. on a 9 per cent grade on the treadmill will raise the body temperature of an unacclimatized person to intolerable levels within an hour on a hot day whereas negro field workers can attain a steady state after a moderate rise in temperature and work on tirelessly for hours. In distance running on a hot day, even the best acclimatization will not make it possible for a man to keep his body temperature down to a tolerable level, because the rate of heat production is so great.







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